AVIATION SAFETY
(Aircraft Passenger Survivability and Cabin Safety)

(98-64)

HEARINGS

BEFORE THE

SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT

OF THE

COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION
HOUSE OF REPRESENTATIVES

NINETY-EIGHTH CONGRESS

FIRST SESSION

JULY 12, 13, 14, 1983—AIRCRAFT PASSENGER SURVIVABILITY
NOVEMBER 1, 2, 1983—CABIN SAFETY

Printed for the use of the Committee on Public Works and Transportation

U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON : 1985

H641-35

COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION

JAMES J. HOWARD, New Jersey, *Chairman*

GLENN M. ANDERSON, California
ROBERT A. ROE, New Jersey
JOHN B. BREAUX, Louisiana
NORMAN Y. MINETA, California
ELLIOTT H. LEVITAS, Georgia
JAMES L. OBERSTAR, Minnesota
HENRY J. NOWAK, New York
ROBERT W. EDGAR, Pennsylvania
ROBERT A. YOUNG, Missouri
NICK JOE RAHALL II, West Virginia
DOUGLAS APPLEGATE, Ohio
GERALDINE A. FERRARO, New York
BRIAN J. DONNELLY, Massachusetts
DONALD JOSEPH ALBOSTA, Michigan
RON de LUGO, Virgin Islands
GUS SAVAGE, Illinois
FOFO I.F. SUNIA, American Samoa
KATIE HALL, Indiana
DOUGLAS H. BOSCO, California
JAMES F. McNULTY, Jr., Arizona
JIM MOODY, Wisconsin
ROBERT A. BORSKI, Pennsylvania
JOE KOLTER, Pennsylvania
TIM VALENTINE, North Carolina
EDOLPHUS TOWNS, New York
WILLIAM O. LIPINSKI, Illinois
MICHAEL A. ANDREWS, Texas
TOM J. VANDERGRIFF, Texas
J. ROY ROWLAND, Georgia
JAMES McCLURE CLARKE, North Carolina
ROBERT E. WISE, Jr., West Virginia

GENE SNYDER, Kentucky
JOHN PAUL HAMMERSCHMIDT, Arkansas
BUD SHUSTER, Pennsylvania
ARLAN STANGELAND, Minnesota
NEWT GINGRICH, Georgia
WILLIAM F. CLINGER, Jr., Pennsylvania
GUY MOLINARI, New York
E. CLAY SHAW, Jr., Florida
BOB McEWEN, Ohio
FRANK WOLF, Virginia
THOMAS E. PETRI, Wisconsin
HAL DAUB, Nebraska
LYNN MARTIN, Illinois
VIN WEBER, Minnesota
ROBERT F. (BOB) SMITH, Oregon
DON SUNDQUIST, Tennessee
NANCY L. JOHNSON, Connecticut
RON PACKARD, California

Subcommittee on Investigations and Oversight

ELLIOTT H. LEVITAS, Georgia, *Chairman*

ROBERT A. ROE, New Jersey
MICHAEL A. ANDREWS, Texas
J. ROY ROWLAND, Georgia
ROBERT E. WISE, Jr., West Virginia
JOHN B. BREAUX, Louisiana
HENRY J. NOWAK, New York
GERALDINE A. FERRARO, New York
DONALD JOSEPH ALBOSTA, Michigan
ROBERT A. BORSKI, Pennsylvania
WILLIAM O. LIPINSKI, Illinois
JAMES J. HOWARD, New Jersey
(Ex Officio)

GUY MOLINARI, New York
NEWT GINGRICH, Georgia
E. CLAY SHAW, Jr., Florida
BOB McEWEN, Ohio
DON SUNDQUIST, Tennessee
NANCY L. JOHNSON, Connecticut
GENE SNYDER, Kentucky
(Ex Officio)

CONTENTS

Proceedings of:

Page
- July 12, 1983 (aircraft passenger survivability) 1
- July 13, 1983 (aircraft passenger survivability) 171
- July 14, 1983 (aircraft passenger survivability) 239
- November 1, 1983 (cabin safety) 655
- November 2, 1983 (cabin safety) 747

TESTIMONY

Ashwood, Thomas, first vice president, Air Line Pilots Association; accompanied by John O'Brien, director, engineering and safety department 290
Biaggi, Hon. Mario, Congressman from New Nork 4
Burnett, Jim, Chairman, National Transportation Safety Board; accompanied by Rudolph Kapustin, senior air safety investigator and hearing officer; and Matthew McCormick, senior human factors engineer 15
De Steiguer, Don, Oklahoma City, OK 762
Finucane, Matthew H., executive director, Aviation Consumer Action Project 508
Grubbs, Roy, Dallas, TX 172
Helms, J. Lynn, Administrator, Federal Aviation Administration; accompanied by Anthony J. Broderick, Deputy Associate Administrator for Aviation Standards; Neal A. Blake, Deputy Associate Administrator for Development and Logistics; and Thomas O'Brien 658
Kaufmann, Monica, secretary/treasurer, Independent Federation of Flight Attendants 485
McKenna, Bonnie Harris, central safety chairperson, Union of Flight Attendants 485
Saito, Janis, director of safety, Association of Flight Attendants 193
Schaitberger, Harold A., legislative director, International Association of Fire Fighters, AFL-CIO-CLC; accompanied by Richard M. Duffy, occupational safety and health coordinator, IAFF 214
Steinman, Commander Alan, U.S. Coast Guard, Washington, DC 747
Werjefelt, Bertil, president, Xenex Corp 241
Williams, Wayne E., president, National Transportation Safety Association, and director, Institute for Survival Technology, Nova University 748

MATERIAL RECEIVED FOR THE RECORD

Aviation Consumer Action Project; supplemental material 538
Biaggi, Hon. Mario, Congressman from New York; newsletter by Congressman Biaggi concerning testimony on "In-flight Fires Aboard Aircraft," presented before the House Public Works and Transportation Subcomittee on Investigations and Oversight, July 12, 1983 8
Burnett, Jim, Chairman, National Transportation Safety Board; statement 20
Duffy, Capt. Henry, president, Air Line Pilots Association; statement 294
Federal Aviation Administration:
- Briefing memorandum, Office of Flight Operations; cabin safety information requested by Mr. Sundquist during hearing on November 1, 1983 696
- Statement on NPRM's; concerning interior cabin material fire safety, antimisting fuel, and other occupant safety improvements, as well as reevaluating previous safety suggestions such as smoke hoods 700
- Summary of NTSB recommendations: unresolved by FAA; rejected by FAA; and recommendations made more than once by NTSB 710

Finucane, executive director, Aviation Consumer Action Project; statement 513
Heftel, Hon. Cecil (Cec), Congressman from Hawaii; statement 14
Helms, J. Lynn, Administrator, Federal Aviation Administration; statement 662

Page
Kaufmann, Monica, secretary/treasurer, Independent Federation of Flight Attendants; statement 489
Letter of July 18, 1983, from John P. Reese, director, airworthiness programs, Aerospace Industries Associaton of America, Inc.; enclosing paper regarding aircraft cabin fire safety design and standards; and a statement submitted by AIA to the Science and Technology, Transportation, Aviation and Materials Subcommittee 552
Letter of July 22, 1983, from Elizabeth H. Murtagh, national safety director, Transport Workers Union of America, AFL-CIO, Local 553, Miami, FL; suggestions and observations concerning aircraft-passenger survivability 639
Letter of August 26, 1983, from John C. Gerard, Washington representative, National Fire Protection Association, Washington DC; enclosing statement for record 643
Letter dated August 30, 1983, to Rudolf Kapustin, senior air safety investigator hearing officer, National Transportation Safety Board, from James E. Huggins, supervisor, Federal Bureau of Investigations, Louisville, KY; concerning an anonymous letter to Jim Burnett, Chairman, NTSB 117
Letter dated July 19, 1983, from Congressmen Elliott H. Levitas and Guy V. Molinari to J. Lynn Helms, Administrator, Federal Aviation Administration; concerning FAA's record of managing its air-safety responsibilities 680
Letter from Don De Steiguer clarifying testimony 767
McKenna, Bonnie Harris, central safety chairperson, Union of Flight Attendants; statement 491
National Transportation Safety Board; cabin safety recommendations which NTSB has given to FAA:
  Aviation safety recommendations on the topic of emergency evacuation and passenger briefings 35
  Aviation safety recommendations on the topic of crew emergency training and crew coordination 66, 150
  Aviation safety recommendations on the topic of in-flight and post-crash fire 77
  Aviation safety recommendations on the topic of emergency evacuation and passenger briefings 119
Saito, Janis, director of safety, Association of Flight Attendants; statement 199
Schaitberger, Harold, legislative director, International Association of Fire Fighters, AFL-CIO-CLC; statement 222
Werjefelt, Bertil, president, Xenex Corp.; statement 247
Xenex Corp.:
  Illustration of PELS Hood 254
  Letter dated August 23, 1983, to Congressman Elliott H. Levitas from Bertil Werjefelt, president, Xenex Corp.; concerning supplemental materials requested concerning "Passenger Safety and Survivability in Airline Cabins," hearings July 12-14, 1983—implementation of toxic fume protective breathing equipment 262
  Letter dated August 23, 1983, to Congressman Elliott H. Levitas from Bertil Werjefelt, president, Xenex Corp.; concerning supplemental materials requested concerning passenger safety and survivability in airline cabins, hearings July 12-14, 1983—cost calculations for the carriage of toxic fume protective breathing equipment on board airlines 280
  Letter dated November 28, 1983, presenting comments in response to FAA statements made to subcommittee 716
Yates, Lisa, director, health and safety, Independent Union of Flight Attendants; statement 541

AVIATION SAFETY

(Aircraft Passenger Survivability and Cabin Safety)

TUESDAY, JULY 12, 1983

House of Representatives,
Subcommittee on Investigations and Oversight,
Committee on Public Works and Transportation,
Washington, DC.

The subcommittee met, pursuant to call, at 10:05 a.m., in room 2167, Rayburn House Office Building, Hon. Elliott H. Levitas (chairman of the subcommittee) presiding.

Mr. Levitas. The subcommittee will please come to order.

Just by way of scheduling announcement, it is the intention of the Chair to hear from the witnesses listed on the agenda. The first witness, of course, is our colleague, Congressman Mario Biaggi of New York. Then we will hear from the chairman of the National Transportation Safety Board and his colleagues.

It is my intention to continue the hearings until about 12 o'clock, at which time we will take a brief recess for lunch. And if we haven't completed the testimony, we will get back on to the hearings this afternoon following a luncheon recess. Of course we will continue the hearings tomorrow.

The Subcommittee on Investigations and Oversight this morning returns to the rather dismal and disappointing record of the Federal Aviation Administration in managing and regulating the safety of the Nation's air transportation system. Just yesterday we marked the 22d anniversary of the crash of a United Airlines DC-8 at Denver, CO, in which none of the 122 passengers were seriously injured as a result of the impact, but 16 of that number subsequently died from carbon monoxide poisoning when the aircraft burned before they had an opportunity to evacuate.

That accident was followed by two other survivable accidents—one at Rome, Italy, in 1964 and the other at Salt Lake City, UT, in 1965—in which a total of 88 passengers were found to have been incapacitated because of toxic fumes and subsequently perished before they could escape from the aircraft.

Following those accidents and numerous others, all of which have been compiled in the evergrowing hearing record of this subcommittee, there ensued an on-again/off-again series of FAA proposed rulemakings dealing with the topics of fire, smoke and toxic fumes, in addition to other proposals affecting cabin safety. Suddenly, in 1978, the FAA announced they were withdrawing all the rules in favor of the creation of a special aviation and fire reduction committee [the SAFER committee].

We questioned the creation of the committee at that time, and again in subcommittee hearings in 1979, suspecting this was yet another delaying tactic to preclude the regulations from catching up with the state of the art. I recall very clearly pointing out to the then FAA Administrator, Langhorne Bond, that I had some serious concerns as to the timetable which had been given for recommendations of the SAFER committee to achieve the rulemaking process and formal adoption of any such rules; 2 to 5 years was listed as the timetable for the recommendations to be made, rules proposed, and their adoption as a standard.

Now, 4 years later, and 17 years after the FAA first issued a notice of proposed rulemaking entitled "Crashworthiness and Passenger Evacuation," we still have as the flammability standard a 1947 regulation. Despite this history of neglect and downright procrastination, we are suddenly informed that the recent pronouncements of the FAA on the soon to be released rulemaking on interior cabin materials is "right on schedule." I believe it is fair to ask—whose schedule? And when was it made up? Certainly this turn of events is not in keeping with this subcommittee's timetable of recommendations and insistence that the standards be revised and updated to reflect the current state of the art.

Unfortunately, and tragically, it takes yet another air disaster to focus public attention on the simple and very obvious fact that the current FAA regulations lag far behind the current level of technology.

The issue before this subcommittee is not whether less flammable materials are available. They are available. We had sworn testimony in past subcommittee hearings that safer, lighter weight materials that resist ignition better than any materials now in use and that at ignition—800 degrees Fahrenheit—the material only chars and decomposes, and that these have been developed for NASA's space program.

Use of material such as this could reduce inflight fire risks and certainly increase the time necessary for passenger evacuation in a survivable crash situation endangered by fire outside the aircraft. Once the regulations are issued which demand use of such products, I am convinced that even better fire resistant, lighter weight, and longer wearing fabrics will appear in the marketplace at competitive prices.

In the meantime, there are other safety measures which could be put into place. Things such as smoke hoods, protective breathing devices, fire and smoke detection devices, automatic discharge fire extinguishers and relocation of emergency lighting to armrest or floor level have been researched, tested and retested, and yet none of these have to this date been mandated by the FAA.

Just recently Congressman Molinari and I visited the FAA facility at the Mike Monroney Aeronautical Center at Oklahoma City and witnessed an impressive demonstration of these emergency lighting systems in a darkened cabin interior. Additionally, our investigative staff has spent many hours looking into the numerous safety innovations which have been suggested as solutions to cabin safety problems.

In the days ahead we shall be examining some technological advances in fire suppression systems, including one which ranges in design from a single zone, single-shot system to complex multiple zone systems which can offer protection to both cabin and cargo compartments, and which can be controlled from the flight deck. This system has been reviewed by our staff, one of whom participated in a demonstration of its effectiveness while encased in a capsule the size of an aircraft lavatory.

Survivability in an aircraft accident too often is a matter of chance, and I believe it is the responsibility of this subcommittee to improve the chances of every passenger to safely evacuate a disabled aircraft. We shall be inquiring into such additional matters as aircraft passenger seat design and seat strengths, flight attendant training, evacuation techniques, and postcrash fires and explosions.

These lifesaving improvements should not be left on the bookshelf of some research facility. We expect the FAA to respond to these hearings, and if they do not, then I fully expect the Congress will respond with some legislation to require the updating of regulatory standards in this area.

Before hearing further from Congressman Biaggi I would like to inquire of the ranking minority member, the gentleman from New York, if he has a statement he would like to make at this time.

Mr. MOLINARI. Thank you, Mr. Chairman. I did have a prepared statement that I was going to read this morning, but rather than do that I choose to make some observations instead.

Preparing for these hearings I got some of the records of prior hearings before the subcommittee, Mr. Chairman. I spent a day and a half reviewing that testimony. And I can say today that I cannot understand how we have permitted the conditions to remain as they have, at a stalemate, for so many years.

I think what I would like to do at this point is just read into the record a couple of statements that you made yourself. The first is taken from a hearing in 1979 where you said:

> This of course is a subject in which I have had a great deal of interest in the past couple of years. I must say that I am very disappointed that we are still talking about the same things in 1979 that I first heard talked about almost verbatim, the same phrases, same words, same concerns, same inaction, since 1975. That is when I got here, so it must have gone on before that. It is the same old record. I fear we are going to hear it again 2, 3, 4 years down the line with another several hundred people perishing in survivable crashes as a result of fire, smoke, and toxicity.

And then this statement hit me—Mr. Levitas was questioning Dr. Kramer and Dr. Parker of NASA. The question was posed:

> Mr. Levitas. How close would you gentlemen say—

Again we are talking about April 1979.

> How close would you gentlemen say we are to developing and having commercially available the next generation, if you will, of materials for cabin interiors that will have reduced toxicity and flammability?
>
> "Dr. Kramer. I think we are there. We are within a couple of years of having airplanes delivered with a significantly safer cabin interior.
>
> Dr. Parker. There is no question about that.
>
> Mr. Levitas. And you say there is no question that we are that close to it?
>
> Dr. Parker. Yes, sir.

Then recently, I guess it was a month or month and a half ago we had Mr. Helms before us. I had asked the question, Mr. Chairman, as to whether they didn't have any technology under consideration at that time that could have saved some of the lives of the people that perished in the Kentucky fire. And he said no, nothing that he knew of.

And I guess it was about 2 weeks later when they came out with this proposal to have a cover to prevent the toxic fumes from coming out of the seats. So I must say that the record here is one that bears a great deal of questioning

As the ranking member of this subcommittee, I don't think we are going to be able to stick around here much longer and permit this to go on. I think the people out there expect a lot more of us. Certainly FAA I think is the prime target. They have to be held accountable. And I hope we are going to be able to do that.

Thank you, Mr. Chairman.

Mr. Levitas. Thank you very much, Mr. Molinari. I appreciate your contribution.

Dr. Rowland?

Mr. Rowland. No, Mr. Chairman.

Mr. Levitas. With that we welcome to the hearings today, as our first witness, a colleague of ours who has been interested and concerned about this matter for quite some time, and has spoken to me privately of his concern and has encouraged our efforts in this regard. We welcome you, Congressman Biaggi, and look forward to your testimony.

TESTIMONY OF HON. MARIO BIAGGI, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW YORK

Mr. Biaggi. Thank you, Mr. Chairman.

I ask that my more detailed statement be included in the record.

Mr. Levitas. Without objection, so ordered.

Mr. Biaggi. Before I proceed with my statement I would like to respond to the observations and statement by the chairman and by the Ranking Minority Member, Mr. Molinari. Clearly, what comes to mind as a result of your comments and the facts is why? Why the delay? Why the bureaucratic indifference? Clearly, there is technology available. The immediate response to the last fire with the fire resistant fabric indicates that some stimulating and influence must be brought to bear. That bureaucratic indifference over the years is responsible for the death of many individuals who might otherwise have been saved.

It is the kind of negligence that could be characterized as criminal negligence and should not be tolerated. We cannot deal with bureaucratic dilatory conduct. That is why you are to be commended, Mr. Chairman, for your interest in this area over the years. And I am confident that your subcommittee, under your leadership, will report legislation out that will be enacted into law very shortly.

The American public will not tolerate this kind of bureaucratic indifference jeopardizing the lives of the flying public. Specifically, I want to address my comments to the need for some basic and vital aircraft safety improvements, installation of smoke detectors and automatic fire extinguishers aboard airliners.

This is a concern reflected in my bill, H.R. 3264, to require that commercial aircraft with a passenger capacity of 30 persons or more have such devices. We need to look no further than to a tragic accident that occurred 6 weeks ago to understand the need for these fire safety improvements.

On June 2, 1983, an in-flight lavatory fire spread out of control on a DC-9 Air Canada jetliner. Serious questions were raised by that accident, questions like could the Air Canada disaster have been prevented? In my mind the answer to that question is yes. It should be noted that the Air Canada disaster is not an isolated incident. In fact, only 9 days later, on June 11, another in-flight lavatory fire occurred aboard a second Air Canada plane headed to Bermuda. On June 25, a third fire broke out in the lavatory waste bin of an Eastern Airlines plane while it was on the runway at Tampa Airport. Fortunately there were no injuries in either incident.

Although it is rare for three aircraft lavatory fires to occur during the same month, there have been a significant number of such incidents over the years. The most tragic in-flight lavatory fire took place on July 11, 1973, aboard a Brazilian Varig Boeing 707-300. Like the first Air Canada fire, the plane made a successful emergency landing, but 124 people died, 78 percent of then due to carbon monoxide poisoning. The aircraft was totally destroyed.

While the loss of life and serious injuries are the real tragedies, it is also important to consider the tremendous costs involved each time one of these fires spreads out of control. For example, the fatal Air Canada accident totally destroyed a plane worth approximately $5.4 million. The other costs resulting from that accident, including the settlement of lawsuits, will add considerably to that amount.

According to one report the total costs resulting from the loss of a medium-size twin engine aircraft, with a passenger capacity of only 10 is $14,750,000. To translate these projections into real terms, the National Transportation Safety Board [NTSB] reports that from 1979 through 1981 there were 14 U.S. air carrier, large jet passenger transport, accidents involving fire. In these fire accidents eight aircraft were totally destroyed by the fires, five other aircraft were damaged and only one aircraft was not damaged by the fire. In addition, 349 persons were killed in these 14 fire-related accidents and 139 other persons were injured.

Mr. Chairman, these numbers are startling, but the most alarming fact—at least about in-flight lavatory fires—is that the Federal Aviation Administration has chosen to reject recommended safety measures aimed at preventing these disasters.

I believe this bureaucratic indifference contributed to the Air Canada disaster. I emphasize, I simply don't understand why they have neglected to implement or follow through on the suggestions made by the National Transportation Safety Board.

As far back as 1973, the NTSB recommended that "the FAA require a means for early detection of lavatory fires on all turbine-powered, transport-category aircraft." This recommendation came less than 3 months after the in-flight lavatory fire aboard the Brazilian Varig plane in Paris.

In supporting their recommendation, which was issued on September 5, 1973, the NTSB stated that:

> The Board is seriously concerned over the number of in-flight fires that have occurred during the past several years as a result of ignition of flammable materials in lavatories of large jet transport aircraft.

However, despite the NTSB's recommendation and the strong evidence they provided to support the need for "a means for early detection of lavatory fires," the FAA rejected the recommendation. To this day there is no explanation, no justification for that delay. And I just don't understand the thinking in that agency.

If they have a valid position, let them come forward with it. We challenge them to that, Mr. Chairman. I am sure you share my sentiments in that regard.

NTSB's concerns were given further credence during a 3-week period in 1974 when inflight lavatory fires broke out in two Boeing jetliners on July 17 and August 9. Persistent in their efforts to prevent further inflight lavatory fires from occurring, the NTSB issued a recommendation to the FAA on December 5, 1974, to "require that automatic-discharge fire extinguishers be installed in lavatory waste paper containers on all transport aircraft."

Once again, however, the FAA rejected the NTSB's recommendation saying such a device was unnecessary.

Interestingly enough, FAA regulations do require airlines to have smoke detectors and built-in, fire-extinguishing systems in their cargo compartments, but not in the passenger area. That is a mind-boggling situation, Mr. Chairman. I simply don't understand the justification for putting them in cargo compartments and not in the passenger area, where there is more likelihood of some ignition.

Clearly, the conclusion, and it may be caustic and it may be cruel, and even sarcastic, if you will, but I think there is a basis for saying the FAA has more regard for cargo than they have for human beings. Current FAA regulations simply require that aircraft carrying 61 or more passengers have 3 handheld fire extinguishers.

It should also be noted, however, that the effectiveness of the handheld fire extinguishers is suspect. A report issued by the FAA in June 1982 stated that "depending on circumstances including human factors, the possibility exists that handheld extinguishers could prove unsuccessful."

Mr. Chairman, unwilling to accept their failure to respond to this critical problem, I have introduced a bill, H.R. 3264, to require commercial aircraft with a passenger capacity of more than 30 persons to be equipped with smoke detectors and automatic fire extinguishers in all lavatories.

This bill would also require an automatic fire extinguisher to be installed in aircraft galleys, where other inflight fires have originated, such as in 1974 when a TWA aircraft caught on fire after a coffee maker exploded. Fifty-two persons were injured in that accident, which occurred on February 16.

Further, the June 1982 FAA report stated that "it is clear that galley fires represent by far the major fire and/or smoke occurrence for the larger aircraft."

The FAA would have 180 days after the enactment of this bill to issue final regulations requiring airlines to make these fire safety improvements.

It should be noted that my bill has been endorsed by the NTSB, the Airline Pilots Association & International Airline Passengers Association, Inc. Especially significant, Mr. Chairman, is that the smoke detectors and automatic fire extinguishers called for in my bill are readily available and easily affordable.

In fact, some of these devices have already been installed aboard certain aircraft. For example, HTL Industries, Inc., 101 East Wheeler Avenue, Arcadia, CA 91006, phone: 213-574-7880, has been providing fire detection and suppression systems for military and commercial aircraft for over 25 years. The state of the art is here. Clearly, the industry recognizes it. Why Government doesn't get involved and pose it as a mandated standard is incredible.

In summary, Mr. Chairman, we have documentation that shows in-flight fires have resulted in hundreds of injured and lost lives as well as millions of dollars in losses to the airline industry. We have a National Transportation Safety Board recommendation that all airliners should have smoke detectors and automatic fire extinguishers in their lavatories to better protect against such disasters.

We have a number of airlines that have voluntarily installed smoke detector and automatic extinguishers in their aircraft because they, too, believe these will help prevent in-flight fires.

Unfortunately, we also have a set of current FAA regulations that requires better fire protection in the aircraft cargo compartments than in the passenger area. We have a report issued by the FAA just last year saying that the hand-held fire extinguishers now required by the FAA aboard aircraft could prove unsuccessful when fighting an in-flight fire. We have an FAA report saying galley fires represent by far the major fire and/or smoke occurrence for the larger aircraft. But what we do not have, Mr. Chairman, is an acceptable FAA response to the total in-flight fire problem.

They want better emergency exit lighting and fire resistant seats aboard airlines. Fine. But why stop there? What about the early detection and suppression of in-flight fires, especially in-flight lavatory and galley fires?

I have introduced legislation which would help achieve this important protection. We have learned that the fire safety devices called for in my bill are readily available, easily affordable and, most importantly, they would help save lives.

The FAA has dragged their feet on the issue of fire safety far too long. Why it is so, I don't understand. Clearly, the need is understood. I certainly look forward one day, and I am sure you do, Mr. Chairman, for an explanation of this dilatory and indefensible conduct. If the FAA cannot be concerned with such a vital issue, then Congress will be.

The prompt and favorable consideration of my bill, or any other bill which would accomplish this end, would demonstrate this resolve in very strong terms. But, while this bill would provide a major first step toward effective in-flight fire protection in the aircraft cabin area, there is much more that can and should be done. The Congress has allocated the FAA a substantial amount of money for the purpose of studying and acting to improve aircraft fire safety. We must demand a better return on that investment. The lives of millions of air travelers may depend on it.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Biaggi follows:]

TESTIMONY ON IN-FLIGHT FIRES ABOARD AIRCRAFT

(By U.S. Representative Mario Biaggi of New York)

Mr. Chairman, as a frequent air traveler and concerned Member of Congress, I greatly appreciate this opportunity to address the critical issue of aircraft cabin safety. You and your subcommittee are to be commended for the considerable amount of attention you have focused on this important issue over the years. This hearing today is a clear demonstration of that commitment.

Specifically, I want to address my comments to the need for some very basic, but vital aircraft fire safety improvements—smoke detectors and automatic fire extinguishers aboard airliners. This is a concern that is reflected in my bill, H.R. 3264, to require that commercial aircraft with a passenger capacity of more than 30 persons install such devices.

We need to look no further than to a tragic event that occurred six weeks ago to understand the need for these fire safety improvements. On June 2, 1983, an in-flight lavatory fire spread out of control on an Air Canada DC9 jetliner during a flight from Dallas-Fort Worth to Toronto. The fire was discovered when the plane was some six miles high and 25 miles away from the Greater Cincinnati Airport, where it eventually landed safely just 13 minutes after the fire was discovered. But, despite the heroic efforts of the flight crew, air traffic controllers, and emergency rescue personnel, 23 lives were lost and 18 others were injured. Only five persons escaped harm.

It should also be noted that the Air Canada disaster is not an isolated incident. In fact, only nine days later, on June 11, another in-flight lavatory fire occurred aboard a second Air Canada plane headed to Bermuda. That fire was determined to be an act of arson by a disgruntled passenger. On June 25, a third fire broke out in the lavatory waste bin of an Eastern Airlines plane while it was on the runway at Tampa (FL) Airport. Fortunately, there were no injuries in either incident.

Although it is rare for three aircraft lavatory fires to occur during the same month, there have been a significant number of such incidents over the years. The most tragic in-flight lavatory fire took place on July 11, 1973, aboard a Brazilian Varig Boeing 707-300. Like the first Air Canada fire, the plane made a successful emergency landing, but 124 people died, 78 percent of them due to carbon monoxide poisoning. The aircraft was totally destroyed.

While the loss of life and serious injuries are the real tragedies, it is also important to consider the tremendous costs involved each time one of these fires spreads out of control. For example, the fatal Air Canada accident totally destroyed a plane worth approximately $5.4 million. The other costs resulting from that accident, including the settlement of lawsuits, will add considerably to that amount.

According to a report issued by William A. Enk, a former airline pilot and now head of Total Flood Corporation—a Missouri-based firm protection systems manufacturer—the total costs resulting from the loss of a medium-size twin engine aircraft, with a passenger capacity of only 10 is $14,750,000.

To translate these projections into real terms, the National Transportation Safety Board (NTSB) reports that from 1979 through 1981 there were 14 U.S. Air Carriers (large jet passenger transport) accidents involving fire. In these fire accidents eight aircraft were totally destroyed by the fires, five other aircraft were damaged and only one aircraft was not damaged by the fire. In addition, 349 persons were killed in these 14 fire-related accidents and 139 other persons were injured.

Mr. Chairman, these numbers are startling, but the most alarming fact—at least about in-flight "lavatory" fires—is that the Federal Aviation Administration (FAA) has chosen to reject recommended safety measures aimed at preventing these disasters.

As far back as 1973, the NTSB recommended that "the FAA require a means for early detection of lavatory fires on all turbine-powered, transport-category aircraft." This recommendation came less than three months after the in-flight lavatory fire aboard the Brazilian Varig plane in Paris.

In supporting their recommendation, which was issued on September 5, 1973, the NTSB stated that "the Board is seriously concerned over the number of in-flight fires that have occurred during the past several years as a result of ignition of flammable materials in lavatories of large jet transport aircraft."

The NTSB also mentioned that: "(1) no fireproof waste material containers are provided in the lavatories; (2) frequently, cigarette butts are found in waste paper containers during cleaning operations at the termination of flights; (3) waste paper fragments and other flammable materials, such as lint and dust particles, can enter inadvertently into terminals or electrical units; (4) full-face smoke masks with emergency oxygen bottles are not provided for the cabin crew; and (5) lavatories are vented in such a manner as to exhaust any odors or smoke in the case of lavatory fires, thus precluding detection in the cabin area until a serious fire is in progress."

The latter point seems especially relevant to the Air Canada disaster. Reports of that accident indicate the fire was not discovered until heavy smoke could be seen coming out of the rear lavatory, and by that time the fire was out of control.

However. despite the NTSB's recommendation and the strong evidence they provided to support the need for "a means for early detection of lavatory fires," the FAA rejected the recommendation.

The NTSB's concerns were given further credence during a three-week period in 1974 when in-flight lavatory fires broke out in two Boeing jetliners on July 17 and August 9. Persistent in their efforts to prevent further in-flight labatory fires from occurring, the NTSB issued a recommendation to the FAA on December 5, 1974, to "require that automatic-discharge fire extinguishers be installed in lavatory waste paper containers on all transport aircraft."

Once again, however, the FAA rejected the NTSB's recommendation saying such a device was unnecessary.

Interestingly enough, FAA regulations do require airlines to have smoke detectors and built-in, fire-extinguishing systems in their cargo compartments, but not in the passenger area. Current FAA regulations simply require that aircraft carrying 61 or more passengers have three hand-held fire extinguishers.

It should also be noted, however, that the effectiveness of the hand-held fire extinguishers is suspect. A report issued by the FAA in June 1982 stated that "depending on circumstances including human factors, the possibility exists that hand-held extinguishers could prove unsuccessful . . . An observation, quite obvious after visiting major carriers, was the lack of consistency in flight crew training. The Federal Aviation Regulation 121.417(c) requires that each crew member must operate each type of fire extinguisher during initial training and once during each 24 calendar months. The FAR does not, in fact, require the fighting of an actual fire, nor, for that matter, the actual discharge of extinguishing agent."

Mr. Chairman, I am bewildered and deeply distressed by the FAA's continued refusal to require even the most basic of in-flight lavatory fire prevention measures. Unwilling to accept their failure to respond to this critical problem, I have introduced a bill, H.R. 3264, to require commercial aircraft with a passenger capacity of more than 30 persons to be equipped with smoke detectors and automatic fire extinguishers in all lavatories.

This bill would also require an automatic fire extinguisher to be installed in aircraft galleys, where other in-flight fires have originated, such as in 1974 when a TWA aircraft caught on fire after a coffee maker exploded. Fifty-two persons were injured in that accident, which occurred on February 16.

Further, the June 1982 FAA report stated that "it is clear that galley fires represent by far the major fire and/or smoke occurrence for the larger aircraft."

The FAA would have 180 days after the enactment of this bill to issue final regulations requiring airlines to make these fire safety improvements.

It should be noted that my bill has been endorsed by the NTSB. In a July 7 letter to me, NTSB Chairman Jim Burnett said, "The recent Air Canada in-flight fire has renewed and heightened our on-going concern with respect to cabin fire safety. We continue to believe that smoke detectors and fire extinguishers should be installed on all transport aircraft, and endorse H.R. 3264 as an effective means of accomplishing this important safety goal."

This legislation has also received support from such prominent groups as the Air Line Pilots Association, and the International Airline Passengers Association, Inc.

Especially significant, Mr. Chairman, is that the smoke detectors and automatic fire extinguishers called for in my bill are readily available and easily affordable. My research has uncovered a number of manufacturers of both the smoke detectors and automatic fire extinguishers, most of which could be easily installed in aircraft lavatories.

In fact, some of these devices have already been installed aboard certain aircraft. For example, HTL Industries, Inc. (101 East Wheeler Avenue, Arcadia, CA 91006, phone: 213-574-7880) has been providing fire detection and suppression systems for military and commercial aircraft for over 25 years.

During that time they have supplied these devices for such aircraft as the 727; the 737-300; the 747; the 757; the 767; the F-14; the F-15; the F-18; the AV8B; the A-10; the A-300; the A-310; and others. HTL is currently supplying fire extinguishers for engines, auxiliary power units, cargo bay areas and galleys of 727, 737, 747, 757 and 767 aircraft. Quantas and United are two of the airlines that have installed HTL fire suppression units in the galleys of their aircraft at a cost of $3,000 per unit.

HTL has also designed an automatic fire extinguishing unit for lavatory use in the Boeing 747 and Airbus A-300 aircraft. The unit, which costs $500, is made to be mounted in the towel/trash bin of the lavatory. It is heat sensitive and upon a fire in the trash bin would automatically discharge. Although not yet available, they have proposed making "a self contained unit housing the smoke detector and the extinguisher to protect the whole lavatory and not just the trash bin."

As is the case with most other automatic fire extinguishing systems that are made today, the HTL extinguisher uses Halon 1301, a fire suppression agent manufactured by DuPont. Halon 1301 is a nontoxic agent that is safe for inhalation by humans up to a concentration of six to eight percent, which is all that is needed for effective fire suppression.

Total Flood Corporation (1409 Plaza Center, Blue Springs, MO 64015, phone: 816-524-6300) offers a fire suppression system that is now being used in about 500 general aviation type aircraft, including Beech, Piper and Cessna, which has been offering it as optional equipment on all of its aircraft since 1977. Interestingly the TFC system has already been approved for use by the FAA.

The TFC systems range in design from simple single zone, one-shot systems for cabin or engine compartments, to complex multiple zone, multi-discharge systems which can protect cabin and fuselage compartments as well as engine and accessory areas. Computer controlled, the TFC system can be activated either manually or automatically.

Especially significant is that the TFC system can be used to flood an entire aircraft with its Halon 1301 agent prior to a crash to help prevent post-crash fires, which were directly responsible for killing 419 U.S. Air Carrier passengers between 1969 through 1979.

The cost of the TFC system varies depending on the complexity of the system used, starting at about $10,000 for the equipment necessary to protect a medium size twin-engine aircraft.

In referring to the TFC system, the FAA report on hand-held fire extinguishers, said, "A well designed, fixed, total flooding fire extinguishing system sized to provide an acceptable agent concentration (along ventilation guidelines) will be at least as effective as hand portables with the advantage of automatic capability."

Kerman Protection (488 Seventh Avenue, New York, New York 10018, phone: 212-244-1888) also makes an automatic fire extinguisher, as well as smoke/heat detectors. Their automatic fire extinguisher, which is heat-sensitive and automatically discharges at 150 degrees Fahrenheit, weights only about 18 pounds fully loaded and costs about $360 per extinguisher. One extinguisher covers 800 cubic feet of space. The Kerman Protection combined smoke/heat detector sells for about $50.

According to the FAA, a number of other companies are also providing smoke detectors and/or automatic fire extinguishers for U.S. airliners. For example, Fenwall Protection Systems (400 Main Street, Ashland, Massachusetts 01721, phone: 617-881-2000) and Walter Kidde (675 Main Street, Belleville, New Jersey 07109, phone: 201-759-5000) both make smoke detectors and automatic fire extinguishers for use in aircraft. Two other companies, Autotronics Corporation (314 E. Live Oak Avenue, Arcadia, CA 91006-5695, phone: 213-445-5470) and Chloride Pyrotectro (333 Lincoln, Higham, Massachusetts 02043, phone: 617-749-3466) make smoke detectors for the Boeing 755 aircraft.

Let me emphasize, once again however, that the airlines which have equipped their aircraft with smoke detectors and/or automatic fire extinguishers have done so on a voluntary basis. These safety devices are not required.

It should be pointed out that the Air Canada jetliner destroyed on June 2 did not have a lavatory smoke detector, but it did have two automatic fire extinguishers that discharged during the fire. Apparently, however, the fire extinguishers were ineffective in combating the fire because they were directed at areas—the trash bin and the neck of the door—other than where the fire originated. Based on my discussions with manufacturers of such products, this is a problem that can be easily remedied.

Mr. Chairman, last month the FAA announced plans to require airlines to mark emergency exits with floor-level lights so they would be easier to find in a smoke-filled cabin, and to place a fire-resistant panel in aircraft seats to slow the spread of flames. I have two major concerns about the FAA's proposal. First, why did the FAA wait until the Air Canada in-flight lavatory fire killed 23 persons to propose new airline fire safety improvements? Second, why is their fire safety proposal so limited in scope?

The FAA proposals do offer some important safety improvements in the event a fire spreads aboard an aircraft. But, if the FAA put more emphasis on early detection and suppression of in-flight fires, the emergency situations their proposed regulations attempt to address might never occur.

The FY 1983 FAA budget for aircraft cabin fire safety is $2.8 million. Last month the House passed a bill, H.R. 3293, which appropriates further funding for ths crucial cause in FY 1984. On June 22, during the full House consideration of H.R. 3293, I engaged the distinguished Chairman of the House Appropriations Subcommittee on Transportation, Mr. William Lehman, in a colloquy on this subject. Specifically, I asked if the funds contained in H.R. 3293 for the FAA were intended "to strengthen aircraft fire safety standards, particularly those relating to the prevention of in-flight lavatory fires?"

Mr. Lehman assured me that "yes, this legislation is intended to help strengthen aircraft fire safety standards. This is a matter we have been encouraging the FAA to act on for years. In view of the Air Canada disaster, I believe a particular focus of the FAA's work, in partnership with the airline industry, should be on better protection against in-flight lavatory fires. The specific proposals contained in my colleague's (Mr. Biaggi's) bill, H.R. 3264, should be given special consideration."

Clearly then, the FAA has been deficient in responding to a longstanding Congressional concern about aircraft fire safety.

In summary, Mr. Chairman, we have documentation that shows in-flight fires have resulted in hundreds of injured and lost lives, as well as millions of dollars in losses to the airline industry. We have a National Transportation Safety Board recommendation that all airliners should have smoke detectors and automatic fire extinguishers in their lavatories to better protect against such disasters. We have a number of airlines that have voluntarily installed smoke detectors and automatic fire extinguishers in their aircraft because they, too, believe these devices will help prevent in-flight fires.

Unfortunately, we also have a set of current FAA regulations that requires better fire protection in the aircraft cargo compartments than in the passenger area. We have a report, issued by the FAA just last year, saying that the hand-held fire extinguishers now required by the FAA aboard aircraft "could prove unsuccessful" when fighting an in-flight fire. And, we have a FAA report saying that "galley fires represent by far the major fire and/or smoke occurrence for the larger aircraft."

But what we do not have, Mr. Chairman, is an acceptable FAA response to the total in-flight fire problem. They want better emergency exit lighting and fire-resistant seats aboard airliners. Fine. But why stop there. What about the early detection and suppression of in-flight fires, particularly in-flight lavatory and galley fires.

I have offered legislation that would help achieve this important objective. We have learned that the fire safety devices called for in my bill are readily available, easily affordable and, most importantly, they would help save lives!

The FAA has dragged their feet on the issue of fire safety far too long. If the FAA cannot be concerned with such a vital issue, then Congress will be. The prompt and favorable consideration of my bill would demonstrate this resolve in very strong terms.

But, while this bill would provide a major first step toward effective in-flight fire protection in the aircraft cabin area, there is much more that can and should be done. The Congress has allocated the FAA a substantial amount of money for the purpose of studying and acting to improve aircraft fire safety. We must demand a better return on that investment. The lives of millions of air travelers may depend on it.

Mr. LEVITAS. Thank you, Congressman Biaggi, for your statement and your concern. I might commend that in the face of needless steps, and the failure of FAA to take effective action, your anger in my opinion is certainly a justifiable and natural human reaction.

I can tell you that it is the purpose of this subcommittee to make certain that the time for inaction is over and the time for getting something done is now at hand. I want to commend you for your concern and your interest, and will assure you that the legislation you have proposed, as well as the concerns you have expressed, will contribute greatly to the results which I predict will be forthcoming.

Mr. Molinari?

Mr. MOLINARI. I also want to congratulate the gentleman from New York for his presentation and the proposed legislation. I also, Mr. Biaggi, at page 5, at the bottom, of your testimony, I think you hit on the head one of the recurring problems with FAA. That is, it seems that it takes a tragedy to get them to react. They will not propose new regulations or safety standards even knowing that sooner or later they are going to be confronted with a crisis and lives will be lost.

But my observation is, and I think you bear this out in your statement, that when a crash occurs, and it is obvious, as the chairman says, that lives were lost that did not have to be lost, then within weeks we get a response from FAA. Had there not been the crash in Kentucky I don't think FAA would have been heard from to this date.

Mr. BIAGGI. I think you made the point, Mr. Molinari. In 1979, when the two doctors testified to the state of the art, regarding equipment that would lower the possibility of ignition and toxicity they said, yes, it was available. It had arrived. And then lately, when Dr. Helms testified, he said he didn't have the knowledge. But right after the Air Canada accident the announcement was made.

Now, that is one hell of a commentary. Really, that is. That is an indictment in itself. The technology was there. And it required, as you refer to it, a tragedy to occur before they moved off their duffs.

Mr. MOLINARI. I agree with the gentleman and I hope that together we can make some progress in this very important field.

Mr. LEVITAS. Dr. Rowland.

Mr. ROWLAND. Thank you, Mr. Chairman. I, too, congratulate the gentleman for the testimony and for the legislation you have presented. As one recently coming to Congress, I, too, am puzzled as to why the FAA has not taken some more dramatic steps to correct this obvious problem. I look forward to seeing what the explanation is.

Mr. LEVITAS. Thank you. I see we have been joined by the distinguished ranking member of the full committee, Congressman Snyder.

Mr. SNYDER. Thank you, Mr. Chairman.

I want to commend our colleague for his testimony. I think it is well developed, and certainly was well presented. I think his forcefulness indicates how strongly he feels about it. As the chairman said, I think it is well justified.

I just have one question, Mario. I was a little bit concerned. We have here the NTSB's testimony which I really haven't read yet. But on the back of it there is a chart that shows the in-flight fire accidents, U.S. air carriers. Then some non-U.S. air carriers. It does not list the three instances that appear on the top of page 2 of your prepared testimony. I will ask them about those when they testify. But I wonder if you know your source of information on that?

Mr. **Biaggi**. I am advised Mr. Snyder that this information was obtained from a report sent to us from the National Transportation Safety Board.

Mr. **Snyder**. All right, thank you. That is interesting. On the back of their prepared testimony they have this list. And I did not see them listed.

Mr. **Biaggi**. It may have slipped between the cup and the lip, either my staff or their staff.

Mr. **Snyder**. We will ask them about it. Maybe you can ask your staff to doublecheck and let us know if there is any error in your statement. I have no reason to believe there is, don't misunderstand me, so we can find out. We would like to have the full list while we are getting them. If they haven't give us the full list, we would like to know why.

I want to commend you on your statement. It was very well prepared and very well given.

Thank you very much, Mr. Chairman.

Mr. **Levitas**. Thank you, Mr. Snyder. I might observe I don't know the explanation. Perhaps you might be able to enlighten us at a later time as to that. But I am of the opinion that one of the problems that we have in the data base is that the type of incidents are frequently categorized in different ways. I believe, for example, that items which you and I would view as an inflight, onboard fire, is sometimes reported not as a fire, but rather as a mechanical difficulty, and therefore in the computer system it doesn't show up as a fire, even though normal people would view it as a fire. They report it as a mechanical difficulty. So it may not get on the same chart.

Mr. **Biaggi**. I have just been updated, Mr. Chairman. Staff tells me that this is from an FAA computer printout from the accidental incident data system [AIDS]. Perhaps the NTSB didn't catch these three incidents.

Mr. **Levitas**. What was that category?

Mr. **Biaggi**. Accident incident.

Mr. **Levitas**. That is the point I was making. It doesn't get reported as a fire even though it is one.

Mr. **Biaggi**. That is correct.

Mr. **Levitas**. Thank you.

Mr. Oberstar.

Mr. **Oberstar**. Thank you, Mr. Chairman. I want to compliment you on holding yet another in a long series of hearings by this subcommittee on the question of aircraft passenger cabin safety, and to compliment our colleague from New York, Mr. Biaggi, on his usual thorough way of presenting a very detailed summary that highlights key issues this subcommittee is concerned with.

We are 7 years, five hearings, thousands of pages of testimony, and several lives lost from the starting point of this subcommittee in holding hearings on aircraft cabin, passenger cabin safety. And still, the accidents persist, lives have been loss, and the FAA has dragged its feet. Dramatic instances of accidents such as those you have summarized, warnings by this subcommittee and experts in the field, and the NTSB all seem to have fallen on rather inattensive ears in the FAA.

I am pleased with the chairman's growing impatience with the agency, and I think that on my part, that era of cooperation with the FAA is over and we have to proceed to legislative action. Such small things as smoke hoods dramatized first by a predecessor chairman of this subcommittee, now majority leader, Jim Wright, which demonstrated that, in the face of overwhelming heat from a blowtorch administered just in front of his face, a smoke hood gives a passenger enough time to escape an aircraft under ordinary accident conditions.

Yet the FAA has refused to implement a regulation requiring smoke hoods at very, very small cost on all aircraft. Lives could have been saved in the instances that you reported on had that regulation been in place and enforced. No excuse. No excuse for not taking actions like that, particularly when they were demonstrated in actual conditions and reported repeatedly in hearings by this committee.

It will be a terrible day when we have to require passengers to carry their own fire extinguishers onboard as a condition of air traffic. I compliment you on the testimony you have presented.

Thank you, Mr. Chairman.

Mr. Levitas. Thank you very much, Mr. Oberstar.

Again, Mario, on behalf of myself and the entire subcommittee, and the millions of people who fly our commercial airlines, I want to thank you for your concern, your interest, and assure you that your contribution is most important and most meaningful. Thank you very much.

Mr. Biaggi. Thank you, Mr. Chairman, for the opportunity to present my testimony. I feel more assured as a result of your stated resolve to clear this situation up. It is one that must be met. We can no longer rely on the executive agencies to respond. The challenge is back in our lap, and I am confident that you and your subcommittee will produce the kind of legislation that will at least reduce these tragedies, and we will be able to look at the situation and say, well, at least we have done the best we can.

Thank you.

Mr. Levitas. Thank you very much. At this point, without objection, the subcommittee will receive for the record a statement from another of our colleagues the Honorable Cecil Heftel of the State of Hawaii:

[Mr. Heftel's statement follows:]

Statement of Congressman Cec Heftel

Mr. Chairman, I appreciate the opportunity to submit a statement regarding the issue of aircraft cabin safety. At the outset I would like to applaud you for your relentless efforts to implement higher standards in the many areas involved in insuring the overall safety of airline passengers.

It is unfortunate that it takes a disaster such as the recent Air Canada fire to spur public action and interest in preventing such an occurrence from happening again. However, it is an even greater disaster when authorities do not learn from experience and continue to make the same errors and mistakes. The Air Canada fire was not the first of its kind, and without prompt action by the FAA it will not be the last. I strongly urge the FAA to take the necessary steps to reduce the possibility of on-board fires and to update the requirements for non-flammable cabin materials. With this action, we should be much closer to reaching our ultimate goal of eliminating the dual threat of smoke and toxic fumes from cabin fires that have claimed too many lives.

Airplanes cannot be made perfectly impervious to fire in the foreseeable future, but that is no reason not to take steps that are available to us now to at least reduce the danger. From testimony at earlier hearings and from statements of those currently involved in the issue, it is apparent that there are seating and interior materials available which could measurably improve the survivability of future fires and crashes. Since the Apollo fire in 1967, NASA has greatly upgraded the materials it uses, and has been a leader in research in this area. NASA has developed materials which could be used by the airline industry, yet the FAA has expressed little interst in its work.

The National Transportation Safety Board has made many suggestions over the years to make aircraft safer for the travelling public. However, the FAA has not taken action to implement these recommended regulation changes, some of which could have possibly saved lives in the Air Canada fire. As an example, in 1973 the NTSB recommended FAA action to require fire extinguishers and smoke detectors in aircraft lavatories. They were rejected by the FAA as being unnecessary. The Air Canada incident may have proved otherwise.

I am encouraged by the recent actions of the director of the FAA, J. Lynn Helms, to require less-flammable seating materials and improved lighting for exit doors that will identify them more easily in smoke-filled cabins. It is disconcerting to note, however, that the NTSB made the original recommendation for these actions some ten years ago. Let us hope that the FAA will act more quickly on suggestions made as a result of your subcommittee's hearings on the problem.

Meanwhile, it must not be forgotten that a proposal of new regulations by the FAA by no means implies that they will ultimately be adopted. The history of the FAA in this regard is spotty at best. The FAA has even failed to take action on recommendations made by the SAFER Committee, a group the FAA established in 1979 to study safety problems. I look forward to an improvement of the FAA's record of following through on proposed regulations under the leadership of Mr. Helms.

I also feel it is imperative that the FAA investigate improvements in the areas of evacuation procedures and training, on-board fire control devices, inspection of electrical systems in airplane lavatories, airport rescue equipment, and cabin material testing procedures. The current regulations in many of these areas have been shown to be outdated, inadequate, or unrealistic. It is time for improvements.

I support your efforts, Mr. Chairman, to enact higher standards for the airline industry. I look forward to improved aircraft safety regulations and will continue to work with my colleagues in Congress to keep air travel the safest form of transportation available. Thank you.

Mr. LEVITAS. The next witness this morning is the Honorable Jim Burnett, Chairman of the National Transportation Safety Board. He is accompanied today by Mr. Rudolph Kapustin, Senior Air Safety Investigator and Hearing Officer; Mr. Matthew McCormick, Senior Human Factors Engineer.

Gentlemen, if you would come to the witness table and raise your right hand.

[Witnesses sworn.]

Mr. LEVITAS. Thank you very much, gentlemen. We appreciate your being here and welcome your testimony.

Mr. Burnett, once again welcome to the subcommittee. I consider the testimony that NTSB will give today among the most significant that has yet been presented. I think it will in large measure give us the background against which these hearings will proceed. You may proceed as you do desire.

TESTIMONY OF JIM BURNETT, CHAIRMAN, NATIONAL TRANSPORTATION SAFETY BOARD, ACCOMPANIED BY RUDOLPH KAPUSTIN, SENIOR AIR SAFETY INVESTIGATOR AND HEARING OFFICER, AND MATTHEW McCORMICK, SENIOR HUMAN FACTORS ENGINEER

Mr. BURNETT. Thank you, Mr. Chairman.

Good morning. It is good to be here with the committee today to attend these hearings on certainly a very important issue as we all recognize.

I would like to introduce again, on my right, Mr. Matthew McCormick, who is the Senior Human Factors Engineer with the Safety Board. And on my left, Mr. Rudy Kapustin, who is a Senior Air Safety Investigator and Hearing Officer with the Safety Board, and is the investigator in charge of the Cincinnati-Air Canada accident.

We are here again on the subject of cabin safety. This committee has shown a great deal of interest in this issue over the years. The Safety Board has been here many times to testify on this matter. We want to congratulate the committee under your leadership, Mr. Chairman, for your persistence on this issue despite the fact that there has been so little movement over the years.

We would like also to congratulate Congressman Biaggi for the leadership that he has shown in introducing legislation to move forward on some of the recommendations the Safety Board has made in the past. In order to clear up the question that arose in connection with the previous testimony, I believe the Congressman did get his information from us. We have a list of four pages here of incidents and accidents that deal with aircraft fire.

The list that we submitted with the prepared testimony was boiled down just to accidents, which, of course, is a much shorter list. We have been very fortunate in this country in that we have had a lot of in-flight fire problems that have not matured——

Mr. SNYDER. Excuse me. While you are explaining that would you tell us the difference between incident and accident?

Mr. BURNETT. Contained in the Board regulations are definitions of accidents and incidents. The difference between the two deals with injuries, the amount of damage to the aircraft and type of damage. For instance, the in-flight fire on an Eastern DC-9 on June 25, which we are investigating, which escaped from the confines of the trash bin in the lavatory is defined as an incident, not an accident. If the airplane had not already landed when it developed, it might have been an accident. Fortunately, it was only an incident, but we still investigate.

Mr. SNYDER. Is it similar to a near-miss?

Mr. BURNETT. Yes. That is a good way to look at it. We don't like to use the term "near-miss," because that is really an illogical statement. It is a near collision. That maybe is a little more poignant description.

Mr. Chairman, the topic of cabin safety, and in particular the issues of in-flight and post-crash fires, has been a priority concern of the Safety Board and its Civil Aeronautics Board predecessor for many years. Our accident investigation activities have identified cabin safety deficiencies which adversely affect the ability of crews and passengers to survive accidents. The Safety Board repeatedly has sought improvement in occupant survivability through safety recommendations, testimony before the Congress and through issuance of special studies and investigations, as well as our responses to rulemaking proposed by the Federal Aviation Administration.

For example, we have sought more realistic criteria for the crashworthiness of aircraft, including passenger seats and crew restraint systems, to reduce injuries in survivable accidents; improved flammability, smoke and toxicity characteristics of cabin materials; improved containment of fuel in a crash minimizing the ignition of fuel to reduce the possibility of postcrash fires; improved evacuation systems, including evacuation slides and emergency lighting; improved emergency training of cabin crews and better coordination between cockpit and cabin crews; better ways to inform passengers of what to do in the event of an emergency; improved oxygen equipment; improved water survival equipment; and improved fire safety of lavatories and cargo compartments.

The Safety Board has long believed that there are means at the disposal of the FAA, the aircraft manufacturers and the airlines to improve significantly upon cabin safety.

We have been highly critical of the FAA's lack of action on cabin safety matters. I hope the announcements recently made by the Administrator and those pending are an indication that a management decision has been made to place a great deal more emphasis on this issue than has been the case in the past.

With your permission, Mr. Chairman, I would like to offer a 6-minute videotape presentation, put together by the NTSB staff, which will provide the subcommittee with an account of the factual findings thus far in our investigation of the June 2 Air Canada DC-9 inflight fire. My written testimony contains a more detailed narrative for the record.

Mr. LEVITAS. Thank you, Mr. Chairman. We will now have the television monitors turned on so that we can see that videotape presentation.

[Videotape presentation.]

Mr. BURNETT. The tape we have just seen provides a dramatic explanation of the cabin fire. The video tape is a new technique we are experimenting with in our investigations. We are proud of our initial efforts.

I would like to mention briefly a few of the recommendations the Safety Board has made on the subject of inflight fires. In 1973, following our participation in the investigation of the Varig Boeing 707 accident near Paris which resulted from a lavatory fire, the Safety Board issued four recommendations on lavatory fire safety. These recommendations proposed the installation of smoke detectors in lavatories and frequent inspection of lavatories by cabin crew members; breathing apparatus with full face masks to allow flight attendants to fight inflight fires, and a review of lavatory fire safety standards. We further recommended that the FAA convene an industry task force to evaluate the fire safety design criteria for closed compartments such as lavatories.

In the 1970's the FAA embarked on an ambitious rulemaking program which sought the views of government, industry and citizens on the flammability and toxicity of cabin materials. The FAA also convened two public hearings in 1977 to further explore these problems. Encouraged by this FAA effort, the Safety Board recommended that the FAA move decisively with a balanced, systematic approach which would also include measures to prevent or control fires inside an aircraft cabin.

In 1978 the FAA withdrew its proposed rulemaking based upon information developed from its two hearings in favor of establishing the government-industry SAFER Committee which was chartered to "examine the factors affecting the ability of the aircraft cabin occupants to survive the postcrash environment and the range of solutions available."

Several recommendations were made by the committee to the FAA which led eventually to the FAA's present fire safety program. This program is directed at finding ways to increase the time available for the occupants to escape from an airplane which has experienced a postcrash fire and to increase the time available to control an inflight fire so a safe landing can be made.

There are two improvements, in addition to the proposed fire-blocking of seats and lowering of emergency lights closer to the floor, which I believe can be implemented in the near term. The first is the use of fire-resistant polycarbonate window panels which were developed in the mid-1970's and have been shown to be almost fully impervious to fire for more than 4 minutes. This would retard a postcrash fire from entering a cabin, thereby providing that vital element of additional time to evacuate. Whatever further developmental work that remains to be done on these windows should be expedited. There is still some developmental work insofar as the lamination problems in a contained pressurized cabin.

The second development is the installation of smoke detectors and fire extinguishers in lavatories and other cabin areas which are not under routine surveillance by the cabin crew. In the case of the recent inflight fire at Cincinnati, had smoke detectors been installed and had the flight crew received earlier notification of the smoke, they may have been able to land the plane sooner.

Furthermore, regardless of the ability of lavatories to contain fires, the flight crew should be alerted any time there is smoke in an area of the airplane which is not under the direct and constant surveillance of the cabin crew. As we saw in the accident at Cincinnati, there was smoke in the lavatory, but the flight crew had no knowledge of it until notified by a flight attendant who, in turn, had been told by a passenger.

The Safety Board is convinced that fire-resistant cabin windows, fire blocking material over seat cushions, improved emergency lights, smoke detectors and fire extinguishers in cabins and smoke alerting systems for crew members can be installed on all newly manufactured air carrier aircraft without undue delay. I would also encourage the retrofitting, where practicable, of existing aircraft with these fire safety features.

In conclusion, I hope that the FAA will accelerate its ongoing research into improved materials used in cabins, as well as implementation of its rulemaking proposals.

Mr. Chairman, I will be pleased to answer any questions you and the other subcommittee members may have. We are able to answer any factual questions, in connection with the Cincinnati investigation, but since the investigation is still in progress we are unable to give you any conclusions.

We will be holding a public hearing beginning on August 15 in Fort Mitchell, KY, which will add to the information that our investigators have collected on scene. Following that we will begin an analysis of our factual data which will result in determination of probable cause and, perhaps, some safety recommendations, although some of the most obvious recommendations that may arise out of this accident have already been made.

[The prepared statement of Mr. Burnett follows:]

TESTIMONY OF
HONORABLE JIM BURNETT

Good morning. I am pleased to be here with you today to discuss issues related to aircraft cabin safety. This Subcommittee has been a diligent watchdog in its efforts to assure that the traveling public is provided the highest level of safety possible, and you are to be commended, Mr. Chairman, for your leadership in pushing for a safer environment in aircraft cabins than now exists.

Before I present my testimony I would like to introduce the staff with me at the table: Mr. Rudolph Kapustin, Senior Air Safety Investigator and Hearing Officer; and Mr. Matthew McCormick, Senior Human Factors Engineer.

The topic of cabin safety, and in particular the issues of in-flight and postcrash fires, have been a priority concern of the Safety Board and its Civil Aeronautics Board predecessor for many years. Our accident investigation activities have identified cabin safety deficiencies which adversely affect the ability of crews and passengers to survive accidents. The Safety Board repeatedly has sought improvement in occupant survivability through safety recommendations, testimony before the Congress and through issuance of special studies and investigations, as well as our responses to rulemaking proposed by the Federal Aviation Administration.

For example, we have sought more realistic criteria for the crashworthiness of aircraft, including passenger seats and crew restraint systems, to reduce injuries in survivable accidents; improved flammability, smoke and toxicity characteristics of cabin materials; improved containment of fuel in a crash minimizing the ignition of fuel to reduce the possibility of postcrash fires; improved evacuation systems, including evacuation slides and emergency lighting; improved emergency training of cabin crews and better coordination between cockpit and cabin crews; better ways to inform passengers of what to do in the event of an emergency; improved oxygen equipment; improved water survival equipment; and improved fire safety of lavatories and cargo compartments.

The FAA Adminstrator's statement before a House Subcommittee on June 27, 1983, with regard to proposed rulemaking to require fire-blocking material on seat cushions is encouraging. Equally encouraging is his subsequent announcement of proposed rulemaking to require that emergency lights be located closer to the cabin floor. These are two of many important improvements which must be made to increase the survivability of both in-flight and postcrash fires.

The Safety Board has long believed that there are means at the disposal of the FAA, the aircraft manufacturers and the airlines to improve significantly upon cabin safety.

We have been highly critical of the FAA's lack of action on cabin safety matters. I hope the announcements just made and those pending are an indication that a management decision has been made to place a great deal more emphasis on this issue than has been the case in the past.

A tragic example of the horror of aircraft cabin fire occurred just last month when an Air Canada DC-9 developed an in-flight fire and was forced to make an emergency landing at the Cincinnati Airport.

With your permission, Mr. Chairman, I would like to offer a six-minute videotape presentation, put together by the NTSB staff, which will provide the Subcommittee with an account of the factual findings thus far in our investigation of this accident. My written testimony contains a more detailed narrative for the record.

I would like to comment before the tape is shown that the Safety Board is experimenting with videotaping as a new investigative tool. I hope the Subcommittee finds it useful and informative.

On June 2, 1983, Air Canada Flight 797, a DC-9, departed from Dallas-Fort Worth at 5:25 p.m. for Toronto, Canada with 5 crewmembers and 41 passengers. About 1 hour 25 minutes after takeoff the flightcrew heard and saw three circuit breakers ~~that~~ For the rear left lavatory's flushing motor had popped. The crew tried unsuccessfully twice to reset the circuit breakers. About 10 minutes after the first attempt and shortly after the second attempt a flight attendant notified the pilots that there was smoke coming from the left rear lavatory. The first smell of smoke was noticed by a flight attendant who was with a passenger seated in row 21; the flight attendant opened the door to the left rear lavatory, saw smoke, and closed the door. The door was reopened and a second flight attendant discharged a CO fire extinguisher into the lavatory.

The first officer left the cockpit and went into the rear cabin to investigate. He did not open the lavatory door because it was hot. He informed the captain of what he had found. While the first officer was out of the cockpit the master caution light came on. Shortly after he returned to the cockpit the left generator failed and the flightcrew informed Air Traffic Control that they had electrical problems. Right after this both the AC and the DC electrical power was lost causing the attitude indicator and horizontal situation indicator to fail. The crew selected emergency power, declared an emergency with Air Traffic Control and requested vectors to the nearest suitable airport. The only flight instruments available to the captain were the standby attitude indicator, airspeed indicator, and altimeter. Since no heading information was available to the flightcrew, the Air Traffic Controller provided "no-gyro" vectors for the airplane to land on runway 27L at the Greater Cincinnati Airport, the nearest suitable airport. Crash fire/rescue equipment was positioned along the runway.

In order to simplify procedures for the flightcrew, arrival control maintained control of communication with Flight 797 throughout the approach and this procedure was coordinated with the tower. Arrival control then provided the flightcrew with range calls during the final approach.

The flight attendants had dispensed ONE TRAY OF wet towels to the passengers ~~until the supply of towels was exhausted.~~ The flight attendants also selected able-bodied passengers to sit near overwing exits and instructed them to open these exits after the airplane was stopped. According to the cabin crew, the smoke remained in the aft portion of the cabin until the start of descent, thereafter it increased and spread throughout the cabin. The smoke was described as heavy, and black and the cabin visibility decreased to a few feet.

A maximum rate of descent was made at 310 knots and the airplane was leveled off initially at 3,000 feet and thereafter a descent was made to 2,000 feet. Smoke was now entering the cockpit and both pilots donned oxygen masks and smoke goggles. The flaps and the landing gear were extended. The smoke in the cockpit had by this time become so thick that the captain had difficulty seeing his airspeed indicator during the final approach. After touchdown, a maximum effort stop was made. Since the electrical system had failed and had rendered the antiskid system inoperative, the main wheel tires blew out during the stop. After the airplane was stopped, the flightcrew executed emergency shut-down procedures. They then attempted to enter the cabin to assist the cabin crew with the passenger evacuation; however, the heat and smoke in the cabin were so intense they were not able to enter the cabin, and they exited the airplane through the cockpit windows.

The left and right forward cabin doors were opened by the cabin crew and the evacuation slides were deployed; some overwing exits were also opened and the surviving passengers and cabin crew used these exits.

Our laboratory is examining wire bundles and pieces of the airplanes' structure and interior furnishings to aid us in finding the ignition source and the material which fueled the fire, and also to determine the fire's path. Initial investigation results indicate that the fire did not originate in the lavatory trash bin. There was one heat-activated Halon type fire extinguisher in the lavatory with nozzles aimed at the trash bin and a second aimed at the chute which led to the bin; this latter nozzle had activated at some time during the fire. The cockpit was not equipped with any indicators to alert the pilots to smoke or abnormally high temperatures in the lavatory or to alert them that the extinguisher had discharged.

Both the Digital Flight Data Recorder and the Cockpit Voice Recorder ceased recording before the emergency descent began.

The FBI has finished its investigation and found no evidence of sabotage.

We are in the process of compiling an inventory of each type of material which was used in the interior of the cabin as well as in other locations throughout the airplane. We do know that the passenger seat cushions were constructed of polyurethene foam and that the cabin was refurbished about 18 months ago.

The Safety Board has ordered a public hearing into this accident to be convened during the week of August 15 in Fort Mitchell, Kentucky, to develop further the facts, conditions and circumstances of this tragic accident.

The tape we have just seen provides a dramatic illustration of the effects of cabin fire. I would like to draw your attention to two charts appended to my testimony which list, as best as our records indicate, postcrash and in-flight fire accidents involving U.S. air carriers. I would like to summarize some highlights from these charts, first with regard to postcrash fires:

- Since 1969 U.S. air carriers have been involved in a total of 90 fatal accidents from all causes. These accidents have claimed almost 3,000 lives.

- Within this same 14-year time frame, 21 of the 90 fatal accidents have involved postcrash fire, but were determined to have been survivable from a crash impact standpoint. Slightly over 12 percent of the occupant fatalities were caused by crash forces and 18 percent, or 419 persons, died as a result of the effects of the postcrash fire. Sixty percent of all occupants survived. (It was not possible to determine precise cause of death in the remaining 10 percent of the fatalities.)

- Since 1980, U.S. air carrier have experienced no impact or fire-related deaths in survivable-related accidents.

With regard to in-flight fire accidents our records show:

- Since 1964 there have been 10 U.S. air carrier accidents caused by in-flight fires.
- In two of these accidents have there been fatalities. One accident in 1964 claimed 39 lives. The second accident, which occurred in 1973, killed the three flight crewmembers, the only occupants on board a cargo aircraft.
- In both of these accidents the fires originated in the cabin.

I would like to review briefly two non-U.S. carrier in-flight fires which resulted in major loss of life. In 1973, a Varig Airlines Boeing 707 experienced a lavatory fire and the pilots were able to make a successful landing in an open field. Unfortunately, before the airplane landed, 123 of the 134 occupants, or over 75 percent, had died from some form of asphyxia resulting from carbon monoxide or other toxic gases.

The second accident occurred in 1980 and involved a Saudi Arabian Lockheed 1011 which experienced a cargo compartment fire in-flight. The airplane landed safely, but the exits were never opened and all 301 persons on board died from inhalation of toxic gases.

A review of the number of in-flight incidents which have involved smoke or fire but no fatalities shows that from 1978 to June 1983 there were 65 mishaps associated with the aircraft's engines, auxiliary power units, electrical systems, galley equipment, cargo and lavatories. Twenty-six cases, two of which were arson, originated in cabins, cargo compartments or in lavatories.

I would like to mention some recommendations we have made on the subject of in-flight fires.

In 1981, following our participation in the investigation of the Saudi Lockheed 1011 accident, we made two recommendations to the FAA with regard to cargo compartment fire safety. In the first recommendation we found that the Nomex liner material in the "D" class cargo compartment was inadequate to contain a fire in the compartment, and we recommended that the FAA either reclassify the compartment to a class "C" or change the compartment liner material. The FAA concurred in our recommendation and the liner material was changed from Nomex to fiberglass.

The second recommendation addressed the FAA's fire safety requirements for cargo compartments having a volume of 500 cubic feet or more. We understand that the FAA has completed some full-scale fire tests of cargo compartments at its Technical Center and that this program is contining. The status of this recommendation will remain open until we evaluate the FAA's report on the tests and its proposed corrective action.to improve cargo compartment fire safety.

In 1973, following our participation in the investigation of the Varig Boeing 707 accident near Paris which resulted from a lavatory fire, the Safety Board issued four recommendations on lavatory fire safety. These recommendations proposed the installation of smoke detectors in lavatories and frequent inspection of lavatories by cabin crewmembers; breathing apparatus with full face masks to allow flight attendants to fight in-flight fires and a review of lavatory fire safety standards. We further recommended that the FAA convene an industry task force to evaluate the fire safety design criteria for closed compartments such as lavatories.

In response to these four recommendations the FAA issued Airworthiness Directives to require "no smoking" placards in lavatories, ash trays outside lavatories and flight attendant announcements warning passengers that smoking was not permitted in lavatories. In addition, flight attendants were expected to inspect lavatories before takeoff and periodically in-flight. Also, the FAA reviewed training programs to make sure crewmembers received training in firefighting techniques. Finally, the FAA required the inspection of the integrity of lavatory waste receptacles. The FAA disagreed with our recommendation that breathing apparatus with full face masks be made available to flight attendants on grounds that this apparatus is needed only in isolated separated compartments such as lower level galleys.

In response to our recommendation that a government-industry task force be convened to examine the issue of fire safety, the National Academy of Sciences established a committee to examine the issue and in 1977 and 1978 published reports on fire safety. Formation of this committee and the subsequent FAA public hearings and proposed rulemaking to improve the fire-retardant characterization of cabin materials eventually led to the formation of the Special Aviation Fire and Explosion Reduction Advisory Committee (SAFER).

In December 1974, as a result of two in-flight incidents which resulted from lavatory fires on board a Boeing 747 and a Boeing 727, the Safety Board recommended that the FAA require fire extinguishers in lavatory waste paper receptacles. The FAA disagreed and to this day maintains that a properly designed and maintained waste receptacle compartment will contain a fire and will cause the fire to extinguish without intervention by a crewmember.

This may well be true. But what happens when a waste receptacle compartment is not maintained in compliance with FAA regulations? We need search no further back in our records than less than a month ago when, on June 25th, a lavatory fire on board a DC-9 was discovered by a flight attendant while the plane was taxiing to the gate on a regularly-scheduled passenger flight from Atlanta to Tampa. The fire was extinguished by airport firefighters before any significant aircraft damage was sustained, but the fire damage pattern indicated that it was not contained within the trash receptacle.

The fire had propagated from the upper area of the trash chute to behind the vanity and the aft wall of the lavatory. The fire would have continued to spread had it not been extinguished as quickly as it was. Inspection of the adjacent, undamaged left lavatory revealed that the upper area of the trash chute behind the disposal door was not sealed to contain a fire as required in the regulations.

The Safety Board issued a recommendation, and the FAA concurred, that immediate inspections be made of all lavatory paper and linen waste receptacle enclosure access doors and disposal doors on all applicable aircraft.

In the 1970s the FAA embarked on an ambitious rulemaking program which sought the views of government, industry and citizens on the flammability and toxicity of cabin materials. The FAA also convened two public hearings in 1977 to further explore these problems. Encouraged by this FAA effort, the Safety Board recommended that the FAA move decisively with a balanced, systematic approach which would also include measures to prevent or control fires inside an aircraft cabin. In 1978 the FAA withdrew its proposed rulemaking based upon information developed from its two hearings in favor of establishing the government-industry SAFER committee which was chartered to:

"examine the factors affecting the ability of the aircraft cabin occupants to survive the postcrash environment and the range of solutions available."

Several recommendations were made by the committee to the FAA which led eventually to the FAA's present fire safety program. This program is directed at finding ways to increase the time available for the occupants to escape from an airplane which has experienced a postcrash fire and to increase the time available to control an in-flight fire so a safe landing can be made.

Of the several SAFER recommendations, perhaps the one that has received the most publicity is the research and development of a fuel additive which would reduce the likelihood of a postcrash fire. An additive known as FM-9 has been tested with promising results at the FAA's Technical Center. The Safety Board is encouraged by progress thus far, but is troubled that major obstacles still remain before its widespread use can be expected on air carrier aircraft. In fact, any antimisting fuel additive is still several years away from utilization to any great extent.

There are two improvements, in addition to the proposed fire-blocking of seats and lowering of emergency lights, which I believe can be implemented in the near term. The first is the use of fire-resistant polycarbonate window panels which were developed in the mid-1970s and have been shown to be almost fully impervious to fire for more than 4 minutes. This would retard a postcrash fire from entering a cabin, thereby providing that vital element of additional time to evacuate. Whatever further developmental work that remains to be done on these windows should be expedited.

The second development is the installation of smoke detectors and fire extinguishers in lavatories and other cabin areas which are not under routine surveillance by the cabin crew. In the case of the recent in-flight fire at Cincinnati, had smoke detectors been installed and had the flightcrew received earlier notification of the smoke, they may have been able to land the plane sooner. Furthermore, regardless of the ability of lavatories to contain fires, the flightcrew should be alerted anytime there is smoke in an area of the airplane which is not under the direct and constant surveillance of the cabin crew. As we saw in the accident at Cincinnati, there was smoke in the lavatory, but the flightcrew had no knowledge of it until notified by a flight attendant who in turn had been told by a passenger.

The Safety Board is convinced that fire-resistant cabin windows, fire blocking material over seat cushions, improved emergency lights, smoke detectors and fire extinguishers in cabins and smoke alerting systems for crewmembers can be installed on all newly-manufactured air carrier aircraft without undue delay. I would also encourage the retrofitting, where practicable, of existing aircraft with these fire-safety features. In conclusion, I hope that the FAA will accelerate its ongoing research into improved materials used in cabins, as well as implementation of its rulemaking proposals.

That concludes my prepared statement, Mr. Chairman, and I will be pleased to answer any questions you and the other Subcommittee Members may have.

INFLIGHT FIRE ACCIDENTS
U. S. AIR CARRIERS
1964 - 1983 1/

DATE	LOCATION	AIRPLANE MAKE AND MODEL	OPERATOR	LOCATION OF FIRE	TOTAL ON BOARD	FATAL-ITIES	NONFA-TALITIES
July 9, 1964	Parrottsville, TN	Viscount	United Air Lines	Cabin	39	39	0
February 16, 1972	Beaumont, TX	Convair 600	Texas Int'l Airlines	Engine	3	0	3
March 19, 1972	Hill AFB, UT	Lockheed 188	Universal Airlines	Engine	3	0	3
August 8, 1973	Washington, DC	Boeing 727	Braniff Airways	Brakes/Wheel well	81	0	81
November 3, 1973	Boston, MA	Boeing 707	Pan American 2/	Cabin	3	3	0
February 16, 1974	Herndon, VA	Boeing 707	Trans World Airlines	Galley (coffee pot explosion)	52	0	52
June 1, 1976	Salina, KS	Lockheed L-1011	Trans World Airlines	Electrical System	4	0	4
March 11, 1978	Fort Myers, FL	Lockheed 188C	Trans-Int'l Airlines	Brakes/Wheel well	8	0	8
November 24, 1979	Freeport, Bahamas	Convair 440	Mackey International	Engine	46	0	46
February 16, 1982	King Salmon, AK	YS-11	Reeve Aleutian Airways	Engine	39	0	39

NON U. S. AIR CARRIERS
(U.S. ACCREDITED REPRESENTATIVE PARTICIPATED IN THE INVESTIGATION)

DATE	LOCATION	AIRPLANE MAKE AND MODEL	OPERATOR	LOCATION OF FIRE	TOTAL ON BOARD	FATAL-ITIES	NONFA-TALITIES
July 11, 1973	Paris, France	Boeing 707	Varig	Rear lavatory	134	123	11
August 19, 1980	Riyadh, Saudi Arabia	Lockheed L-1011	Saudi Airlines	C-3 cargo compt	301	301	0
June 2, 1983	Cincinatti, Ohio	Douglas DC-9-32	Air Canada	Aft lavatory	46	23	23

1/ Preliminary data through June 14, 1983.
2/ Cargo Operation

U.S. AIR CARRIERS
ACCIDENT STATISTICS 1969 THROUGH 1983 1/
ALL ACCIDENTS VERSUS FIRE INVOLVED ACCIDENTS

	NUMBER OF ACCIDENTS FROM ALL CAUSES				NUMBER OF ACCIDENTS WITH FIRE				NUMBER OF SURVIVABLE ACCIDENTS INVOLVING POST-CRASH FIRE				
YEAR	NO.	OCCUPANTS	FATAL ACCIDENTS	FATALITIES	NO.	OCCUPANTS	NUMBER FATALITIES	NUMBER SURVIVORS	NO.	OCCUPANTS	FATALITIES		NUMBER SURVIVORS
											IMPACT	FIRE	
1969	63	4085	10	158	4	175	30	145	1	5	0	0	5
1970	55	3025	8	142	16	980	138	842	2	284	0	49	235
1971	48	3490	8	197	11	467	197	270	1	31	1	27	3
1972	50	3676	8	177	13	685	161	524	3	110	19	38	53
1973	43	3074	9	226	11	760	146	614	0	-	-	-	-
1974	47	3835	9	467	10	1000	366	634	2	183	37	131	15
1975	45	4010	3	124	9	996	122	874	2	156	115	7	34
1976	28	2041	4	45	8	733	41	692	2	138	13	25	100
1977	26	2118	5	655	3	732	575	157	2	481	2/ 102	138 2/	84
1978	25	2628	6	163	5	489	141	348	1	200	0	4	196
1979	33	1835	6	353	2	358	341	17	1	87	3/ -	- 3/	17 3/
1980	20	1290	2	14	3	551	0	551	3	551	0	0	551
1981	27	2867	4 4/	4 4/	2	104	0	104	1	100	0	0	100
1982	18	1643	5	235	4	533	154	379	0	-	-	-	-
1983	7	439	3	27	3	221	26	195	0	-	-	-	-
TOTAL	534	40052	90	2987	104	8784	2438	6346	21	2326	287	419	1393
PERCENT			16.9	7.5	19.5		27.8	72.2	20.2		12.3	18.0	59.9

1/ Preliminary Data for 1983, through June 14, 1983.

2/ Ref. B-747 accident at Tenerife: The cause of death of 157 fatalities could not be determined positively. The 138 fire fatalities were identified as such by the Armed Forces Institute of Pathology upon autopsy of all fatalities.

3/ Western Airlines DC-10 accident at Mexico City, October 21, 1979, was investigated by the General Directorate of Civil Aviation, United States of Mexico. The Accident Report contains no information on cause of death. Thus, it is not possible to determine the effects of fire upon the Total Fatalities listed in this Table.

4/ Two accidents included fatal injuries to ground personnel during activities pursuant to flight. One accident involved fatal injuries to a passenger who fell from a boarding platform prior to flight.

Mr. **Levitas**. Thank you very much, Mr. Burnett.

Let me start off by asking if you can provide the subcommittee with the number of cabin safety recommendations which NTSB has given to FAA with respect to flammability, toxicity, onboard or postcrash fires, evacuation techniques, items of that sort, say, over the last 13, 15 years.

Mr. **Burnett**. We can for the record, Mr. Chairman.

Mr. **Levitas**. All right. In that submission I would like for you to list also the number of those recommendations that are still open, the number that have been accepted and the number that were rejected. And in each instance identify what the recommendation was that pertains to each risk.

Mr. **Burnett**. We will do that, Mr. Chairman.

[The information received from Mr. Burnett follows:]

AVIATION SAFETY RECOMMENDATIONS ON THE TOPIC OF EMERGENCY EVACUATION AND PASSENGER BRIEFINGS

RECOMMENDATION: 5-RE-45, FEBRUARY 18, 1965, REFORM GOVERNMENT-INDUSTRY TASK GROUP TO REASSESS SAFETY PROVISIONS AS A RESULT OF LESSONS LEARNED FROM ROME CRASH FIRE AND EVACUATION, NAMELY

- o REDUCED EVACUATION TIME
- o MARGINAL EVACUATION CHUTE MATERIAL AND DEPLOYMENT METHOD
- o NO EMERGENCY ALARM SYSTEM
- o INADEQUATE PASSENGER EMERGENCY EVACUATION BRIEFING

SOURCE OF RECOMMENDATION: TRANS WORLD AIRLINES
B-707-331,
ROME, ITALY
NOVEMBER 23, 1964

STATUS: CLOSED

TOPIC: EVACUATION/BRIEFING

RECOMMENDATION: 6-RE-26, NOVEMBER 30, 1965

- o REQUIRE A PROCEDURE BE USED SO THAT THE EMERGENCY LIGHTS ARE TURNED "ON" DURING ALL TAKEOFF AND LANDING OPERATIONS OF B-707, -720, AND -727 AIRCRAFT, AS WELL AS ALL OTHER TURBINE POWERED AIRCRAFT WITH AUTOMATIC EMERGENCY LIGHTING SYSTEMS.
- o CONDUCT A STUDY OF ALL OTHER TYPE AIRCRAFT BE MADE TO ASCERTAIN THE OPERATING FEATURES OF THEIR EMERGENCY AND EXIT CIRCUITRY TO ASSURE THE EMERGENCY LIGHTING OPERATING DURING ANY EMERGENCY.

SOURCE OF RECOMMENDATION: UNITED AIR LINES
B-727
SALT LAKE CITY, UTAH
NOVEMBER 11, 1965

STATUS: CLOSED

RECOMMENDATION: A-63-033, November 8, 1962
THE NTSB RECOMMENDS TO THE FEDERAL AVIATION AGENCY: (1) LIFE RAFT STOWAGE: PASSENGERS WERE UNABLE TO USE THE LIFE RAFTS STOWED IN THE WINGS. THE ONLY RAFT USED BY THE SURVIVORS WAS THE ONE STOWED IN THE FUSELAGE. THE BOARD RECOMMENDS THAT THE FAA RECONSIDER THE METHOD OF LIFE RAFT STOWAGE WITH A VIEW TO REQUIRE THE STORING OF ALL LIFE RAFTS INSIDE THE FUSELAGE. (2) LIGHTS ON LIFE RAFTS AND JACKETS: THE ONLY LIGHT AVAILABLE OUTSIDE THE AIRCRAFT WAS A FLASHLIGHT CARRIED BY THE CAPTAIN. PASSENGERS HAD DIFFICULTY LOCATING THE RAFT OR ONE ANOTHER IN THE WATER. HAD THE RAFT BEEN LIT AND HAD THERE BEEN A LIGHT INSTALLED ON EACH LIFE JACKET, MORE PASSENGERS WOULD HAVE SURVIVED. THE BOARD THEREFORE, RECOMMENDS THAT AN APPROVED LIGHTING SYSTEM BE REQUIRED FOR LIFE RAFTS AND THAT ALL LIFE JACKETS BE EQUIPPED WITH A SELF-ACTUATING LIGHT. (3) ADEQUACY OF LIFE JACKETS TSO C13: PASSENGERS COMPLAINED THAT THE JACKETS RODE UP AND AROUND THEIR HEADS AND INTERFERED WITH SWIMMING. ALSO, THE SHORT LENGTH OF THE CO2 CARTRIDGE LANYARD PRECLUDED THE AUTOMATIC INFLATION OF THE JACKET. IN VIEW OF THESE COMPLAINTS, THE BOARD RECOMMENDS THAT THE APPLICABLE TSO (TSO C13) BE REVIEWED TO INSURE THAT AN ADEQUATE LEVEL OF SAFETY IS BEING PROVIDED BY THE DETAIL REQUIREMENTS. (4) ADEQUACY OF SEAT TIE-DOWNS: ALTHOUGH THE DECELERATION WAS NOT EXTREME, MANY PASSENGERS FAILED TO EXTRICATE THEMSELVES BECAUSE OF SEAT FAILURES IN THIS SURVIVABLE ACCIDENT. THE BOARD WAS CONVINCED FROM THIS AND OTHER ACCIDENTS THAT AN INCREASE IN THE MINIMUM LEVEL OF SAFETY WAS LONG OVERDUE AND IT IS RECOMMENDED THAT THE STUDIES RELATIVE TO CRASH LOAD FACTORS AND DYNAMIC SEAT TESTING CRITERIA WHICH WE UNDERSTAND ARE NOW UNDER WAY IN YOUR AGENCY BE EXPEDITED TOWARD THE END OF ACHIEVING IMPROVED SAFETY IN THIS AREA AT THE EARLIEST DATE. (5) EMERGENCY INFORMATION: MANY PASSENGERS WHO SURVIVED THIS ACCIDENT AND OTHERS SUCH AS THE UAL DC-8 ON 7/11/61, THE AMERICAN B-720 AT BOSTON ON 9/24/61, AND THE AMERICAN L-188 AT KNOXVILLE ON 8/6/63 DID NOT KNOW THE LOCATION OF THE NEAREST EXIT. THE BOARD FOUND THAT THE PRINTED INSTRUCTIONS IN THE SEAT BACK POCKETS WERE NOT ENOUGH AND RECOMMENDS THAT PASSENGERS BE BRIEFED PRIOR TO THE TAKEOFF ROLL ON THE LOCATION AND ACTUATION OF EMERGENCY EXITS AND THE PROCEDURE TO BE FOLLOWED IN THE EVENT OF AN ACCIDENT.

SOURCE OF RECOMMENDATION: FLYING TIGER LINE, INC.,
L-1049H SERIES,
NORTH ATLANTIC,
September 23, 1962

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-67-016, April 17, 1967
IT IS RECOMMENDED THAT ALL PASSENGERS BE MADE AWARE OF THE PROCEDURES REQUIRED TO MOVE THE SEATS OUT OF THE WAY OF THE WINDOW EXITS. FURTHER, IT IS RECOMMENDED THAT AIRLINES UTILIZING MOVABLE PARTITIONS BETWEEN PASSENGER COMPARTMENTS ASSURE THAT THE OVERHEAD SIGNS ARE PROPERLY PLACED TO DEPICT THE EXACT LOCATION OF THE WINDOWEXITS AND THAT THE FLIGHT ATTENDANTS BE REQUIRED TO INDICATE WHERE EACH EMERGENCY EXIT IS LOCATED DURING THE PRE-TAKEOFF BRIEFING.

SOURCE OF RECOMMENDATION: April 17, 1967

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION [illegible]

RECOMMENDATION: A-68-031, November 4, 1968
THE BOARD RECOMMENDED: (1) AIR CARRIERS BE REQUIRED TO HAVE THE RETAINER BAR FOR ALL DOOR-MOUNTED SLIDES PLACED IN POSITION FOR SLIDE DEPLOYMENT AT THE FLOOR-LEVEL EMERGENCY EXITS PRIOR TO THE AIRCRAFT'S DEPARTURE FROM THE RAMP FOR FLIGHT. (2) FAA INSPECTORS REVIEW ALL PRINTED CARDS USED BY THE AIR CARRIERS TO SUPPLEMENT THE ORAL BRIEFING TO ENSURE THAT THEY INCLUDE CLEAR INSTRUCTIONS SHOWINGTHE DIRECTION PASSENGERS SHOULD TAKE UPON LEAVING THE WING WHENEVER OVER-THE-WING EXITS ARE USED FOR EVACUATING THE AIRCRAFT. (3) ALL AIR CARRIERS RE-EMPHASIZE, THROUGH THEIR CREW TRAINING PROGRAMS, THE BASIC PHILOSOPHY OF EMERGENCY EVACUATION THAT ALL CABIN EXITS THAT ARE NOT JUMPED, BLOCKED BY FIRE, OR OTHERWISE RENDERED UNUSABLE(INCLUDING VENTRAL STAIRS) SHOULD BE USED TO THE EXTENT REASONABLY POSSIBLE.

SOURCE OF RECOMMENDATION: AMERICAN AIRLINES, INC.,
727 SERIES,
SPRINGFIELD, ILLINOIS,
September 23, 1968

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-70-011, February 13, 1970
THE ADMINISTRATOR REQUESTED THE SAFETY BOARD'S VIEWS ON THE MATTER OF PASSENGERS DRINKING ABOARD AIR CARRIER AIRCRAFT. THE BOARD'S RECORDS FAILED TO INDICATE ANY AIR CARRIER TRANSPORT ACCIDENT IN WHICH DRINKING BY A PASSENGER CONTRIBUTED TO ITS CAUSE. NEVERTHELESS, THE BOARD, IN ITS BELIEF THAT UNRESTRICTED DRINKING BYPASSENGERS COULD PROVE HAZARDOUS, PARTICULARLY DURING THE EVACUATIONOF AN AIRPLANE FOLLOWING AN EMERGENCY, AGREED WITH THE ADMINISTRATOR, THAT A SELF-IMPOSED INDUSTRY-WIDE RESTRICTION APPEARED TO BE THE BEST SOLUTION TO THE PROBLEM. IF HOWEVER, THE INDUSTRY AMONG THEMSELVES COULD NOT REACH A SATISFACTORY AGREEMENT, OR IF THEIR IMPLEMENTATION OF AN AGREED LIMIT PROVED UNSATISFACTORY,THEN THE ADMINISTRATOR APPLY A REGULATORY LIMIT.

SOURCE OF RECOMMENDATION: February 13, 1970

STATUS: CLOSED - ACCEPTABLE ACTION

[illegible]: EVACUATION/SIGNS

RECOMMENDATION: A-70-015, April 3, 1970
THE BOARD RECOMMENDED: 1. THAT THE FAA AMEND PART 121 OF THE FAR'S TO REQUIRE THAT ANY TIME "FASTEN SEAT BELTS" SIGNS ARE TURNED ON IN FLIGHT, THE CREW MAKE A VERBAL ANNOUNCEMENT OVER THE PUBLIC ADDRESS SYSTEM TO ADVISE THE PASSENRS OF THE FACT, AND 2. THAT THE FAA CANVASS ALL CARRIERS, SUBJECT TO THE PROVISIONS OF SECTION 121.317 (A) WITH A VIEW TOWARD ASSURING READILY VISIBLE WARNING SIGNS AT ALLSEATING POSITIONS.

SOURCE OF RECOMMENDATION: UNITED AIR LINES, INC.,
720 SERIES,
JANESVILLE, WISCONSIN,
July 26, 1969

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-70-045, September 10, 1970
REQUIRE THAT THE ITEM "WARN PASSENGERS" BE INSERTED AS ONE OF THE LAST ITEMS ON THE EMERGENCY LANDING OR DITCHING CHECKLISTS OF ALL CARRIERS, YET SUFFICIENTLY ADVANCED ON THE LIST TO INSURE ADEQUATE TIME FOR PASSENGERS TO BRACE FOR A CRASH.

SOURCE OF RECOMMENDATION: ANTILLIAANSE LUCHTVAART MAATSCHAPPIJ (ALM),
DC-9 SERIES,
ST. CROIX, VIRGIN ISLANDS,
May 2, 1970

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-70-055, October 29, 1970
THE FAA INSURE THAT NO FLIGHT REQUIRING THE BRIEFING OF PASSENGERS REGARDING EMERGENCY PROCEDURES BE DISPATCHED WITHOUT AN OPERABLE PUBLIC ADDRESS SYSTEM. THE SYSTEM SHOULD BE FUNCTIONING SO THAT THE FLIGHT DECK CREW CAN SPEAK TO THE PASSENGERS AND A CABIN ATTENDANT CAN SPEAK TO THE PASSENGERS FROM AT LEAST ONE CABIN STATION.

SOURCE OF RECOMMENDATION: ANTILLIAANSE LUCHTVAART MAATSCHAPPIJ (ALM),
DC-9 SERIES,
ST. CROIX, VIRGIN ISLANDS,
May 2, 1970

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-71-018, April 12, 1971
THE FEDERAL AVIATION ADMINISTRATION INSTITUTE APPROPRIATE REGULATORYACTION TO PROHIBIT THE SERVICING OF OXYGEN SYSTEMS WHILE PASSENGERS ARE ON BOARD.

SOURCE OF RECOMMENDATION: UNITED AIR LINES, INC.,
737 SERIES,
WASHINGTON, DISTRICT OF COLUMBIA,
December 31, 1970

STATUS: CLOSED - UNACCEPTABLE ACTION

RECOMMENDATION: A-71-044, October 5, 1971
CANVASS AIR CARRIERS TO DOCUMENT THE SERVICE PROBLEMS FOUND WITH THECABIN INTERPHONE SYSTEM INSTALLED IN THE BOEING 747 WITH A VIEW TO ELIMINATING SUCH CONDITIONS AS LOOSE AND IMPROPERLY PLACED HANDSETS,DIALING DELAYS, AND OTHER SYSTEM LIMITATIONS.

SOURCE OF RECOMMENDATION: PAN AMERICAN WORLD AIRWAYS, INC.,
747 SERIES,
February 7, 1971

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-71-045, October 5, 1971
REQUIRE AN INDEPENDENT MEANS FOR ACCESS TO THE PUBLIC ADDRESS SYSTEMAT THE CABIN ATTENDANT STATIONS IN TRANSPORT AIRCRAFT IN GENERAL ANDTHE BOEING 747 IN PARTICULAR.

SOURCE OF RECOMMENDATION: PAN AMERICAN WORLD AIRWAYS, INC.,
747 SERIES,
February 7, 1971

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-72-065, June 28, 1972
EXPEDITE THE DEVELOPMENT OF THE SLIDE- RAFT COMBINATION AND REQUIRE INSTAL- LATION OF THIS DEVICE ON ALL U.S. AIR CARRIER AIRCRAFT AT AN EARLY DATE.

SOURCE OF RECOMMENDATION: OVERSEAS NATIONAL AIRWAYS, INC.,
DC-9 SERIES,

SOURCE OF RECOMMENDATION: ANTILLIAANSE LUCHTVAART MAATSCHAPPIJ (ALM),
ST. CROIX, VIRGIN ISLANDS,
May 2, 1970

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-72-067, June 28, 1972
AMEND FAR PART 129, "OPERATIONS OF FOREIGN AIR CARRIERS," TO INCLUDE THE SAFETY PROVISIONS OF SUBPART T OF PART 121 GOVERNING THE BRIEFING OF PASSEN- GERS, OR INCLUDE THESE PROVISIONS IN THE OPERATIONS SPECIFICATIONS ISSUED TO FOREIGN AIR CARRIERS BY THE ADMINISTRA- TOR; AND REQUIRE THAT APPROVED WORDING FOR SUCH BRIEFINGS BE INCLUDED IN THE APPROPRIATE FLIGHT/OPERATIONS MANUALS OF THE APPLICABLE CREWMEMBERS.

SOURCE OF RECOMMENDATION: OVERSEAS NATIONAL AIRWAYS, INC.,
DC-9 SERIES,

SOURCE OF RECOMMENDATION: ANTILLIAANSE LUCHTVAART MAATSCHAPPIJ (ALM),
ST. CROIX, VIRGIN ISLANDS,
May 2, 1970

STATUS: CLOSED - UNACCEPTABLE ACTION

RECOMMENDATION: A-72-068, June 28, 1972
COLLABORATE WITH THE AIR TRANSPORT ASSOCIATION IN THE DEVELOPMENT OF MORE EFFECTIVE METHODS FOR CONVEYING SAFETY INFORMATION TO PASSENGERS. RESEARCH SHOULD BE CONDUCTED IN THE APPLICATION OF COMMUNICATION TECHNIQUES, BEHAVIORAL SCIENCES, AND OPTIMUM LEARNING SITUATIONS. THE RECENT ADVANCES IN AUDIO-VISUAL TECHNIQUES SHOULD ALSO BE EXPLORED.

SOURCE OF RECOMMENDATION: OVERSEAS NATIONAL AIRWAYS, INC.,
DC-9 SERIES,

SOURCE OF RECOMMENDATION: ANTILLIAANSE LUCHTVAART MAATSCHAPPIJ (ALM),
ST. CROIX, VIRGIN ISLANDS,
May 2, 1970

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION, BRIEFINGS

RECOMMENDATION: A-72-072, June 28, 1972
THE AIR TRANSPORT ASSOCIATION COLLABORATE WITH FOREIGN CARRIERS, THROUGH THE INTERNATIONAL AIR TRANSPORT ASSOCIATION, IN THE STANDARDIZATION OF METHODS FOR CONVEYING SAFETY INFORMATION TO PASSENGERS.

SOURCE OF RECOMMENDATION: OVERSEAS NATIONAL AIRWAYS, INC.,
DC-9 SERIES,

SOURCE OF RECOMMENDATION: ANTILLIAANSE LUCHTVAART MAATSCHAPPIJ (ALM),
ST. CROIX, VIRGIN ISLANDS,
May 2, 1970

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-72-084, July 6, 1972
REQUIRE SELF-ILLUMINATING HANDLES FOR ALL TYPE I AND TYPE A EXITS.

SOURCE OF RECOMMENDATION: July 6, 1972

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-72-127, August 25, 1972
REQUIRE THAT WHENEVER THE PASSENGER SEATBELT LIGHT IS TURNED ON, IRRESPECTIVE OF WHETHER OR NOT THE FLIGHT ATTENDANTS ARE PERFORMING PASSENGER SERVICE DUTIES, THEY SHALL IMMEDIATELY VISUALLY CHECK SEATBELTS AND REMIND THE PASSENGERS TO KEEP BELTS SNUGLY FASTENED.

SOURCE OF RECOMMENDATION: NATIONAL AIRLINES, INC.,
747 SERIES,
LAKE CHARLES, LOUISIANA,
January 4, 1972

STATUS: CLOSED - ACCEPTABLE ALTERNATE ACTION

RECOMMENDATION: A-72-128, August 28, 1972
FEDERAL AVIATION REGULATION 121.571 BE REVISED TO STATE THAT THE APPROPRIATE CREWMEMBER MUST PHYSICALLY POINT OUT THE LOCATION OF ALLEMERGENCY EXITS ON EACH AIRCRAFT PRIOR TO EACH TAKEOFF. AS A GENERALRULE PASSENGERS DO NOT LISTEN TO THE ORAL ANNOUNCEMENTS. THIS WAS TESTIFIED TO DURING THE PUBLIC HEARING RELATIVE TO THIS ACCIDENT. HOWEVER, PASSENGERS WILL TEND TO WATCH A FLIGHT ATTENDANT WHO PHYSICALLY POINTS OUT THE AREA OF EXITS AND WILL RETAIN THEREFORE A GENERAL IDEA OF THE LOCATION OF SUCH EXITS PARTICULARLY THOSE NEAREST TO THEM.

SOURCE OF RECOMMENDATION: ALLEGHENY AIRLIENS, INC.,
580 SERIES,
NEW HAVEN, CONNECTICUT,
June 7, 1971

STATUS: CLOSED - UNACCEPTABLE ACTION

RECOMMENDATION: A-72-131, August 28, 1972
PREVIOUSLY EFFECTIVE FEDERAL AVIATION REGULATION 121.391, "FLIGHT ATTENDANTS," REQUIRING TWO FLIGHT ATTENDANTS FOR MORE THAN 44 PASSENGERS BE REINSTATED WITHOUT ANY WAIVERS, EXEMPTIONS OR DEVIATIONS (AS ALLOWED UNDER EXEMPTION 1108B). AS WE HAVE PREVIOUSLYPOINTED OUT IN OUR COMMENTS REGARDING NOTICE OF PROPOSED RULE MAKING70-35 (SEE APPENDIX J), THE BOARD DID NOT RECOMMEND A PERMANENT RULECHANGE BUT RATHER THAT THE PARTIAL EXEMPTION SHOULD BE EXTENDED FOR A PERIOD OF TIME DURING WHICH A PROGRAM FOR COLLECTION OF APPROPRIATE DATA CAN BE ACCOMPLISHED. THE EXEMPTION ALLOWED CERTAIN CARRIERS TO OPERATE A 50-PASSENGER AIRCRAFT WITH ONE FLIGHT ATTENDANT FOR A 44-PASSENGER SEATING CAPACITY AND TWO FLIGHT ATTENDANTS FOR A 44- TO 99-PASSENGER SEATING CAPACITY. FLIGHT ATTENDANTS SHOULD BE SO DISTRIBUTED WITHIN THE CABIN OF THE CV-580 SO AS TO ASSURE SAFE EVACUATION OF PASSENGERS SHOULD THE INJURY OR FATALITY OF ONE FLIGHT ATTENDANT DURING THE IMPACT SEQUENCE RENDER HER PARTIALLY OR FULLY INCAPACITATED. AS DEMONSTRATED IN THIS ACCIDENT, TWO FLIGHT ATTENDANTS, OFFERING LEADERSHIP AND ASSISTANCE FROM ALL AVAILABLE WINDOW EXITS AND THE MAIN CABIN DOOR, WOULD EXPEDITE ANY EVACUATION.

SOURCE OF RECOMMENDATION: ALLEGHENY AIRLIENS, INC.,
580 SERIES,
NEW HAVEN, CONNECTICUT,
June 7, 1971

STATUS: CLOSED - UNACCEPTABLE ACTION

RECOMMENDATION: A-72-132, August 28, 1972
THE INSTRUCTIONS FOR OPENING THE CONVAIR 580 REAR SERVICE DOOR WHICHARE PRESENTLY AFFIXED TO THIS DOOR SHOULD BE SUBJECTED TO A THOROUGHSTUDY AND REEVALUATION. THE PRESENT INSTRUCTIONS ARE MISLEADING. SIMPLE AND CLEAR LANGUAGE SHOULD BE SUBSTITUTED, SUCH AS "REMOVE PLASTIC COVER, OPEN DOOR, PULL RED INFLATE CORD." ADDITIONALLY, THE LOCKING MECHANISM (WHICH IS EASILY MISTAKEN FOR A DOOR HANDLE) SHOULD BE COVERED WITH AN OPAQUE LIGHT-WEIGHT MATERIAL OR SOME OTHERDEVICE WHICH WOULD BLEND WITH THE CABIN INTERIOR MATERIAL AND COULD NOT BE MISTAKEN AS PART OF THE EGRESS SYSTEM IN AN EMERGENCY SITUATION. A COMPLETE MODIFICATION OF THE DOOR HANDLE TO SIMPLIFY ITS OPERATION SHOULD BE CONSIDERED AS AN ALTERNATE SOLUTION.

SOURCE OF RECOMMENDATION: ALLEGHENY AIRLIENS, INC.,
580 SERIES,
NEW HAVEN, CONNECTICUT,
June 7, 1971

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-72-133, August 28, 1972
PRESENT PROVISIONS FOR EMERGENCY EXIT LIGHTS FOR UTILIZATION DURING DARKNESS OR SMOKE CONDITIONS BE EVALUATED. DURING DARKNESS OR SMOKE CONDITIONS, IT IS VITALLY IMPORTANT TO HAVE SOME FORM OF LIGHT AVAILABLE TO DIRECT AND CONDUCT EMERGENCY EVACUATIONS AS WELL AS TO READ OPERATING INSTRUCTIONS. SURVIVING PASSENGERS INDICATED THAT THECABIN WAS DARK, AND EXITS WERE DIFFICULT TO SEE.

SOURCE OF RECOMMENDATION: ALLEGHENY AIRLIENS, INC.,
580 SERIES,
NEW HAVEN, CONNECTICUT,
June 7, 1971

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-72-135, August 28, 1972
ADEQUATE SHOULDER HARNESSES BE PROVIDED ON ALL AIRPLANES FOR THE FLIGHT ATTENDANTS AT THEIR ASSIGNED SEATS. THIS WOULD GIVE ADDED PROTECTION, ASSURE SURVIVAL AND PREVENT ADDITIONAL INJURIES TO FLIGHT ATTENDANTS AND ASSURE LEADERSHIP FOR PASSENGER EVACUATION.

SOURCE OF RECOMMENDATION: ALLEGHENY AIRLIENS, INC.,
580 SERIES,
NEW HAVEN, CONNECTICUT,
June 7, 1971

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION BRIEFINGS

RECOMMENDATION: A-72-136, August 28, 1972
THE EMERGENCY INSTRUCTIONS FOR THE INDIVIDUAL AIRPLANE BE DISPLAYED ON THE BACK OF THE SEATS IN EYE LEVEL SIGHT OF THE PASSENGER, TO PROVIDE ADDED ASSURANCE THAT THE PASSENGER IS FULLY AWARE OF VITAL SAFETY AND SURVIVAL INFORMATION. EFFORTS SHOULD ALSO BE EXERTED BY THE INDUSTRY IN COOPERATION WITH REGULATORY AND CONSUMER PROTECTION AGENCIES TO ASCERTAIN THAT ALL VITAL SAFETY INFORMATION BE DISSEMINATED TO THE TRAVELING PUBLIC IN A STRAIGHTFORWARD, CLEAR, AND EXPLICIT MANNER.

SOURCE OF RECOMMENDATION: ALLEGHENY AIRLIENS, INC.,
580 SERIES,
NEW HAVEN, CONNECTICUT,
June 7, 1971

STATUS: CLOSED - RECONSIDERED

RECOMMENDATION: A-72-141, August 31, 1972
THE FAA REQUIRE ALL AIR CARRIER AIRCRAFT TO BE EQUIPPED WITH AN AUDIO AND VISUAL EVACUATION ALARM SYSTEM. THIS SYSTEM SHOULD BE CAPABLE OF BEING ACTIVATED IN THE COCKPIT AND AT EACH FLIGHT ATTENDANT'S STATION. THE ALARM SYSTEM SHOULD BE SELF-POWERED SO THATINTERRUPTION OF THE AIRCRAFT ELECTRICAL SYSTEMS WILL NOT INTERFERE WITH USE OF THE EVACUATION ALARM.

SOURCE OF RECOMMENDATION: PAN AMERICAN WORLD AIRWAYS, INC.,
747 SERIES,
SAN FRANCISCO, CALIFORNIA,
July 30, 1971

STATUS: CLOSED - UNACTABLE ACTION

TOPIC: EVACUATION BRIEFINGS

RECOMMENDATION: A-72-142, August 31, 1972
THE FAA REVIEW THE SLIDE PACK MOUNTING DESIGN, GAS GENERATOR RETENTION DESIGN, AND THE PROTECTION OF THE WHEELWELL MOUNTED GAS GENERATOR INSTALLATION. THIS REVIEW SHOULD BE MADE TO DETERMINE WHATACTIONS CAN BE TAKEN TO IMPROVE THESE COMPONENTS AND MAKE THEM MORE RELIABLE.

SOURCE OF RECOMMENDATION: PAN AMERICAN WORLD AIRWAYS, INC.,
747 SERIES,
SAN FRANCISCO, CALIFORNIA,
July 30, 1971

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-72-143, August 31, 1972
THE FAA TAKE ADDITIONAL STEPS TO ENSURE THAT ALL CABIN CREWMEMBERS ARE PROPERLY INFORMED REGARDING THE SAFETY EQUIPMENT INSTALLED IN THE CABIN AND THAT THE EMERGENCY EQUIPMENT USED FOR PASSENGER DEMONSTRATION IS THE SAME AS THAT PROVIDED FOR THE PASSENGERS' USE.

SOURCE OF RECOMMENDATION: PAN AMERICAN WORLD AIRWAYS, INC.,
747 SERIES,
SAN FRANCISCO, CALIFORNIA,
July 30, 1971

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-73-003, May 23, 1973
AMEND SECTION 121.317 OF THE FEDERAL AVIATION REGULATIONS TO REQUIRETHAT SEATBELT SIGNS BE LEGIBLE TO EACH PERSON, WHETHER HE IS SEATED OR STANDING, LOCATED IN GALLEYS, LOUNGES, LAVATORIES, OR LAVATORY WAITING AREAS.

SOURCE OF RECOMMENDATION: AAS-73-1, May 23, 1973

STATUS: CLOSED - RECONSIDERED

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-73-004, May 23, 1973
REQUIRE THAT "LAVATORY OCCUPIED" SIGNS BE INSTALLED. THESE SIGNS SHOULD BE OF SUFFICIENT SIZE, COLOR, AND BRIGHTNESS AS TO BE LEGIBLETO ALL PERSONS IN THE CABIN, WHETHER THE PERSONS ARE SEATED OR STANDING.

SOURCE OF RECOMMENDATION: AAS-73-1, May 23, 1973

STATUS: CLOSED - RECONSIDERED

RECOMMENDATION: A-73-006, May 23, 1973
THE NATIONAL TRANSPORTATION BOARD RECOMMENDS THAT THE AIR TRANSPORT ASSOCIATION OF AMERICA AND MEMBER AIR CARRIERS: INITIATE A STUDY TO DEVELOP INNOVATIVE METHODS FOR INFORMING PASSENGERS OF SAFETY EQUIPMENT AND SEATBELT USAGE. THE WORK OF DOUGLAS AIRPLANE DIVISION,MCDONNELL DOUGLAS CORPORATION, MAY SERVE AS A GUIDE TO THE MORE EFFECTIVE TECHNIQUES FOR PRESENTING PASSENGER SAFETY INFORMATION.

SOURCE OF RECOMMENDATION: AAS-73-1, May 23, 1973

STATUS: CLOSED - ACCEPTABLE ALTERNATE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-73-014, May 18, 1973
THE FEDERAL AVIATION ADMINISTRATION TAKE ACTION TO ENSURE THAT THE ARMING OF THE EMERGENCY CABIN LIGHTING BE INCLUDED IN CHECKLISTS USED BEFORE EACH TAKEOFF AND LANDING.

SOURCE OF RECOMMENDATION: MOHAWK AIRLINES INC.,
FH-227B SERIES,
ALBANY, NEW YORK,
March 3, 1972

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-73-041, June 25, 1973
AMEND 14 CFR 25.812 TO REQUIRE PROVISIONS FOR THE STOWAGE OF A PORTABLE, HIGH-INTENSITY LIGHT AT CABIN ATTENDANT STATIONS; AND AMEND 14 CFR 121.310 TO REQUIRE THE INSTALLATION OF SUCH PORTABLE, HIGH-INTENSITY LIGHTS AT CABIN ATTENDANT STATIONS.

SOURCE OF RECOMMENDATION: NORTH CENTRAL AIRLINES, INC.,
DC-9 SERIES,

SOURCE OF RECOMMENDATION: UNITED AIR LINES, INC.,
737 SERIES,

SOURCE OF RECOMMENDATION: EASTERN AIR LINES, INC.,
L-1011 SERIES,
CHICAGO, ILLINOIS,
December 20, 1972

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFING

RECOMMENDATION: A-73-042, June 25, 1973
AMEND 14 CFR 25.812 TO REQUIRE EXIT SIGN BRIGHTNESS AND GENERAL ILLUMINATION LEVELS IN THE PASSENGER CABIN THAT ARE CONSISTENT WITH THOSE NECESSARY TO PROVIDE ADEQUATE VISIBILITY IN CONDITIONS OF DENSE SMOKE.

SOURCE OF RECOMMENDATION: NORTH CENTRAL AIRLINES, INC.,
DC-9 SERIES,

SOURCE OF RECOMMENDATION: UNITED AIR LINES, INC.,
737 SERIES,

SOURCE OF RECOMMENDATION: EASTERN AIR LINES, INC.,
L-1011 SERIES,
CHICAGO, ILLINOIS,
December 20, 1972

STATUS: CLOSED - UNACCEPTABLE ACTION

RECOMMENDATION: A-73-043, June 25, 1973
AMEND 14 CFR 25.812 TO PROVIDE AN ADDITIONAL MEANS FOR ACTIVATING THE MAIN EMERGENCY LIGHTING SYSTEM TO PROVIDE REDUDANCY AND THEREBY IMPROVE ITS RELIABILITY.

SOURCE OF RECOMMENDATION: NORTH CENTRAL AIRLINES, INC.,
DC-9 SERIES,

SOURCE OF RECOMMENDATION: UNITED AIR LINES, INC.,
737 SERIES,

SOURCE OF RECOMMENDATION: EASTERN AIR LINES, INC.,
L-1011 SERIES,
CHICAGO, ILLINOIS,
December 20, 1972

STATUS: CLOSED - UNACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-73-053, August 10, 1973
AMEND THE EXISTING CERTIFICATION AND OPERATING RULES FOR AIR CARRIER AND AIR TAXI AIRCRAFT TO INCLUDE PROVISIONS REQUIRING TACTILE GUIDANCE AND IMPROVED VISUAL GUIDANCE TO EMERGENCY EXITS, ASWELL AS MORE EFFICIENT METHODS OF INDICATING THE LOCATION OF EMERGENCY EXITS IN A DARK OR SMOKE ENVIRONMENT.

SOURCE OF RECOMMENDATION: NORTH CENTRAL AIRLINES, INC.,
DC-9 SERIES,

SOURCE OF RECOMMENDATION: DELTA AIR LINES, INC.,
880 SERIES,

SOURCE OF RECOMMENDATION: EASTERN AIR LINES, INC.,
L-1011 SERIES,
CHICAGO, ILLINOIS,
December 20, 1972

STATUS: CLOSED - ACCEPTABLE ALTERNATE ACTION

RECOMMENDATION: A-74-102, December 4, 1974
AMEND 14 CFR 25.772 TO REQUIRE THAT PILOT COMPARTMENT DOORS BE DESIGNED TO PROVIDE A MEANS FOR THE COCKPIT CREW TO EGRESS THROUGH THE DOORWAY TO THE CABIN, EVEN IF THE DOOR BECOMES JAMMED.

SOURCE OF RECOMMENDATION: TRANS WORLD AIRLINES, INC.,
707 SERIES,
LOS ANGELES, CALIFORNIA,
January 16, 1974

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-74-103, December 4, 1974
AMEND 14 CFR 121.313 TO REQUIRE THAT, AFTER A REASONABLE DATE, A MEANS BE PROVIDED FOR THE COCKPIT CREW TO EXIT THROUGH THE PILOT COMPARTMENT DOOR TO THE CABIN EVEN IF THE DOOR BECOMES JAMMED.

SOURCE OF RECOMMENDATION: TRANS WORLD AIRLINES, INC.,
707 SERIES,
LOS ANGELES, CALIFORNIA,
January 16, 1974

STATUS: CLOSED - UNACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-74-105, January 5, 1975
REQUIRE THAT AIR CARRIERS REPORT ALL EMERGENCY EVACUATION SLIDE DEPLOYMENTS, FAILURES, AND MALFUNCTIONS TO THE FAA.

SOURCE OF RECOMMENDATION: AAS-74-3, January 5, 1975

STATUS: CLOSED - UNACCEPTABLE ACTION

RECOMMENDATION: A-74-106, January 5, 1975
DEVELOP A MAINTENANCE SURVEILLANCE PROGRAM TO INSURE GREATER RELIABILITY OF EMERGENCY EVACUATION SLIDE SYSTEMS.

SOURCE OF RECOMMENDATION: AAS-74-3, January 5, 1975

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-74-107, January 5, 1975
AMEND 14 CFR 25.809 TO REQUIRE THAT THE LENGTH OF THE EMERGENCY EVACUATION SLIDES BE SUCH THAT THE ANGLE WITH THE GROUND RENDERS THE SLIDE SAFE AND USABLE AFTER COLLAPSE OF ONE LEG, OR MORE, OF THE LANDING GEAR, AND AMEND 14 CFR 121.310 TO REQUIRE THAT THESE NEW SLIDES BE INSTALLED AFTER A REASONABLE DATE.

SOURCE OF RECOMMENDATION: AAS-74-3, January 5, 1975

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-74-108, January 5, 1975
AMEND 14 CFR 121.310 TO REQUIRE, AFTER A REASONABLE DATE, THAT EMERGENCY EVACUATION SLIDES ON ALL FLOOR-LEVEL EXITS BE AUTOMATICALLY INFLATED UPON DEPLOYMENT.

SOURCE OF RECOMMENDATION: AAS-74-3, January 5, 1975

STATUS: CLOSED - UNACCEPTABLE ACTION

RECOMMENDATION: A-74-109, January 5, 1975
AMEND 14 CFR 25.812 TO REQUIRE THAT EXTERIOR EMERGENCY LIGHTING BE ACTIVATED AUTOMATICALLY WHEN EXITS ARE OPENED IN THE EMERGENCY MODE,AND AMEND 14 CFR 121.310 TO REQUIRE SUCH AUTOMATIC ACTIVATION AFTER SOME REASONABLE DATE.

SOURCE OF RECOMMENDATION: AAS-74-3, January 5, 1975

STATUS: CLOSED - UNACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-74-110, January 5, 1975
REQUIRE THAT THE AIR CARRIERS DESIGNATE THE FLIGHT ATTENDANT(S) WHO WILL BE RESPONSIBLE FOR USE OF THE MEGAPHONE(S) DURING AN EVACUATION, AND RELOCATE THE MEGAPHONE(S) SO THEY ARE WITHIN EASY REACH OF THAT FLIGHT ATTENDANT(S)' SEAT. CONSIDERATION SHOULD BE GIVEN TO THE INSTALLATION OF NEW, LIGHT AND COMPACT MEGAPHONES TO FACILITATE STOWAGE AND USE.

SOURCE OF RECOMMENDATION: AAS-74-3, January 5, 1975

STATUS: CLOSED - RECONSIDERED

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-74-111, January 5, 1975
AMEND 14 CFR 121.318 TO REQUIRE AFTER A REASONABLE DATE, THAT PUBLIC ADDRESS SYSTEMS BE CAPABLE OF OPERATING ON A POWER SOURCE INDEPENDENT OF THE MAIN AIRCRAFT POWER SUPPLY.

SOURCE OF RECOMMENDATION: AAS-74-3, January 5, 1975

STATUS: CLOSED - UNACCEPTABLE ACTION

RECOMMENDATION: A-74-112, January 5, 1975
REQUIRE THAT AIR CARRIER PASSENGERS BE ALERTED, DURING PRETAKEOFF BRIEFINGS, OF THE NEED TO FAMILIARIZE THEMSELVES WITH THE PROCEDURES INVOLVED IN THE OPERATION OF EMERGENCY EXITS.

SOURCE OF RECOMMENDATION: AAS-74-3, January 5, 1975

STATUS: CLOSED - ACCEPTABLE ALTERNATE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-74-113, January 5, 1975
ISSUE AN ADVISORY CIRCULAR WHICH WOULD PROVIDE STANDARDIZED GUIDANCE TO THE AIR TRANSPORT INDUSTRY ON EFFECTIVE METHODS AND TECHNIQUES FOR CONVEYING SAFETY INFORMATION TO PASSENGERS.

SOURCE OF RECOMMENDATION: AAS-74-3, January 5, 1975

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-75-060, July 31, 1975
ISSUE AN AIR CARRIER OPERATIONS BULLETIN REQUIRING PRINCIPAL OPERATIONS INSPECTORS TO ALERT THEIR ASSIGNED AIR CARRIERS TO THE IMPORTANCE OF ASSIGNING EMERGENCY DUTIES AND SEATING LOCATIONS TO EXTRA FLIGHT ATTENDANTS CARRIED ON BOARD AIRCRAFT IN EXCESS OF THE NUMBER REQUIRED BY 14 CFR 121.391 SO THAT THEY ARE MORE EVENLY DISTRIBUTED THROUGHOUT THE AIRCRAFT TO PROVIDE MORE EFFECTIVE GUIDANCE TO PASSENGERS AT MORE EXITS DURING AN EMERGENCY EVACUATION.

SOURCE OF RECOMMENDATION: AMERICAN WORLD AIRWAYS,
707 SERIES,
ANCHORAGE, ALASKA,
January 30, 1974

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-75-067, August 14, 1975
EVALUATE THE FEASIBILITY OF USING THE CITABRIA'S LEFT FRONT SIDE WINDOW AS AN ALTERNATE EMERGENCY EXIT.

SOURCE OF RECOMMENDATION: 7KCAB SERIES,
HILLSBORO, OREGON,
February 5, 1975

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-76-025, April 29, 1976
ISSUE AN ADVISORY CIRCULAR (AC) TO ALL PART 121, 123, AND 135.2 CERTIFICATE HOLDERS TO PROVIDE GUIDELINES FOR IMPROVED PASSENGER BRIEFINGS AND PRINTED INSTRUCTIONS FOR THE USE OF CHEMICAL SUPPLEMENTAL OXYGEN SYSTEMS.

SOURCE OF RECOMMENDATION: DC-10 SERIES,

SOURCE OF RECOMMENDATION: L-1011 SERIES,
April 29, 1976

STATUS: CLOSED - ACCEPTABLE ALTERNATE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-76-026, April 29, 1976
ISSUE AN OPERATIONS BULLETIN FOR A REVIEW OF ORAL BRIEFINGS AND PASSENGER SAFETY CARDS FOR EACH PART 121, 123, AND 135.2 CERTIFICATEHOLDER TO ASSURE THAT BRIEFINGS AND PRINTED INSTRUCTIONS FOR THE USEOF THE PASSENGER CHEMICAL SUPPLEMENTAL OXYGEN SYSTEM ARE FACTUAL ANDUNAMBIGUOUS AND CONFORM TO THE GUIDELINES OF THE ABOVE AC.

SOURCE OF RECOMMENDATION: DC-10 SERIES,

SOURCE OF RECOMMENDATION: L-1011 SERIES,
April 29, 1976

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-76-120, August 13, 1976
REQUIRE THAT THE MMELS OF PASSENGER-CARRYING AIRPLANES BE STANDARDIZED TO REQUIRE THAT THE P. A. SYSTEM BE OPERABLE FROM THE COCKPIT AND FROM AT LEAST ONE FLIGHT ATTENDANT STATION AT ALL TIMES.

SOURCE OF RECOMMENDATION: August 13, 1976

STATUS: OPEN - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-77-028, May 23, 1977
ISSUE AN AIR CARRIER OPERATIONS BULLETIN CLARIFYING THE DESIGNATION OF THE DC-9 TAIL CONE EXIT AS A REQUIRED EXIT AND REQUIRING THAT PRINCIPAL OPERATIONS INSPECTORS ASSIGNED TO DC-9 OPERATORS INSURE THAT THEIR ASSIGNED AIR CARRIERS PROVIDE INSTRUCTIONS IN THEIR PASSENGER BRIEFINGS AND ON THEIR PASSENGER INFORMATION CARDS ON THE AVAILABILITY AND OPERATION OF THE TAIL CONE EXIT AS AN EMERGENCY EXIT.

SOURCE OF RECOMMENDATION: TEXAS INTERNATIONAL AIRLINES, INC.,
DC-9 SERIES,
DENVER, COLORADO,
November 16, 1976

STATUS: CLOSED - ACCEPTABLE ALTERNATE ACTION

RECOMMENDATION: A-77-029, May 23, 1977
ISSUE AN AIRWORTHINESS DIRECTIVE TO REQUIRE THAT AN EMERGENCY LIGHT SOURCE BE LOCATED IN CLOSE PROXIMITY TO THE DC-9 TAIL CONE RELEASE HANDLE OR THAT THE HANDLE BE SELF-ILLUMINATING.

SOURCE OF RECOMMENDATION: TEXAS INTERNATIONAL AIRLINES, INC.,
DC-9 SERIES,
DENVER, COLORADO,
November 16, 1976

STATUS: CLOSED - ACCEPTABLE ALTERNATE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-79-016, May 1, 1979
THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: FUND AND GIVE HIGHEST PRIORITY TO AN EVACUATION SLIDE FABRIC TEST PROJECT WITH A VIEW TOWARD DEVELOPING AND CERTIFICATING FIRE-RESISTANT MATERIALS FOR THESE DEVICES.

SOURCE OF RECOMMENDATION: CONTINENTAL AIRLINES, INC.,
DC-10 SERIES,
LOS ANGELES, CALIFORNIA,
March 1, 1978

STATUS: OPEN - ACCEPTABLE ACTION

RECOMMENDATION: A-79-017, May 1, 1979
ISSUE AN AIRWORTHINESS DIRECTIVE REQUIRING THE STRENGTHENING OF THE GIRT FABRIC OF THE PICO 26-FOOT SLIDE/RAFT TO INSURE ITS RELIABILITY WHEN THE UNIT IS DEPLOYED AT ITS MOST CRITICAL ANGLE.

SOURCE OF RECOMMENDATION: CONTINENTAL AIRLINES, INC.,
DC-10 SERIES,
LOS ANGELES, CALIFORNIA,
March 1, 1978

STATUS: OPEN - ACCEPTABLE ACTION

RECOMMENDATION: A-79-018, May 1, 1979
AMEND TECHNICAL STANDARD ORDER C69 TO ADDRESS REQUIREMENTS FOR DUAL-LANE EVACUATION SLIDES AND TO REQUIRE CRITICAL ANGLE PERFORMANCE TESTING FOR THESE DEVICES.

SOURCE OF RECOMMENDATION: CONTINENTAL AIRLINES, INC.,
DC-10 SERIES,
LOS ANGELES, CALIFORNIA,
March 1, 1978

STATUS: OPEN - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-79-019, May 1, 1979
ISSUE A TECHNICAL STANDARD ORDER FOR SLIDE/RAFT DEVICES.

SOURCE OF RECOMMENDATION: CONTINENTAL AIRLINES, INC.,
DC-10 SERIES,
LOS ANGELES, CALIFORNIA,
March 1, 1978

STATUS: OPEN - ACCEPTABLE ACTION

RECOMMENDATION: A-79-020, May 1, 1979
AMEND 14 CFR 25.809 TO REQUIRE A SECONDARY MEANS OF ESCAPE AT ALL FLOOR-LEVEL CABIN EXITS CURRENTLY REQUIRING EMERGENCY ESCAPE SLIDES. THESE SECONDARY ESCAPE MEANS COULD BE ROPES OR OTHER MEANS DEMONSTRATED TO BE SUITABLE FOR EVACUATION PURPOSES.

SOURCE OF RECOMMENDATION: CONTINENTAL AIRLINES, INC.,
DC-10 SERIES,
LOS ANGELES, CALIFORNIA,
March 1, 1978

STATUS: CLOSED - NO LONGER APPLICABLE

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-79-037, June 1, 1979
AMEND 14 CFR 121.571 TO REQUIRE THAT PASSSENGERS BE BRIEFED ON THE LOCATION OF APPROVED FLOTATION DEVICES BEFORE EACH FLIGHT THAT REQUIRES THE AIRCRAFT TO PASS OVER A LARGE BODY OF WATER DURING TAKEOFF, DEPARTURE, APPROACH, OR LANDING.

SOURCE OF RECOMMENDATION: NATIONAL AIRLINES, INC.,
727 SERIES,
ESCAMBIA BAY, PENSACOLA, FLORIDA,
May 8, 1978

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-79-039, June 1, 1979
EXPEDITE THE ISSUANCE OF THE NOTICE OF PROPOSED RULE MAKING WHICH ADDRESSES REVISIONS TO TSO - C13C (14 CFR 37.123) FOR LIFEVESTS. THE REVISIONS TO THIS TSO SHOULD ELIMINATE THE DIFFICULTIES IDENTIFIED IN THIS ACCIDENT WITH RESPECT TO THE PACKAGING, DONNING, AND OPERATION OF LIFEVESTS BY UNINSTRUCTED SUBJECTS UNDER STRESS.

SOURCE OF RECOMMENDATION: NATIONAL AIRLINES, INC.,
727 SERIES,
ESCAMBIA BAY, PENSACOLA, FLORIDA,
May 8, 1978

STATUS: OPEN - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-79-062, August 24, 1979
THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: ISSUE AN AIR CARRIER MAINTENANCE BULLETIN CLARIFYING THE CONTENT OF 14 CFR 25.811(D) REGARDING THE CONSPICUITY OF PASSENGER EMERGENCY EXIT SIGNS WHEN EXITS ARE OPEN AND THE REQUIREMENT FOR EXIT SIGNS TO BE RELOCATED IN AIRCRAFT WHICH HAVE SIGNS AFFIXED ON THE EXIT CLOSURE.

SOURCE OF RECOMMENDATION: UNITED AIR LINES, INC.,
DC-8 SERIES,
PORTLAND, OREGON,
December 28, 1978

STATUS: CLOSED - ACCEPTABLE ALTERNATE ACTION

RECOMMENDATION: A-79-064, August 24, 1979
THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: EXPEDITE THE RELEASE OF OPERATIONS REVIEW PROGRAM NOTICE NO. 13 CONTAINING THE SAFETY BOARD'S 1974 RECOMMENDATION REGARDING A POWER SOURCE FOR PUBLIC ADDRESS SYSTEMS INDEPENDENT OF THE MAIN AIRCRAFT POWER SUPPLY IN PASSENGER CARRYING AIRCRAFT.

SOURCE OF RECOMMENDATION: UNITED AIR LINES, INC.,
DC-8 SERIES,
PORTLAND, OREGON,
December 28, 1978

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: [illegible]AON/BRIEFINGS

RECOMMENDATION: A-81-028, March 20, 1981
THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: AMEND 14 CFR 23.783, 14 CFR 23.807(B)(3), AND 14 CFR PART 91 TO REQUIRE EXTERNAL DOORS AND EMERGENCY EXITS OF AIRCRAFT TO BE CONSPICUOUSLY MARKED ON THE OUTSIDE WITH DIRECTIONS FOR OPENING THE DOOR.

SOURCE OF RECOMMENDATION: PA-28 SERIES,
LAVINA, MONTANA,
June 4, 1977

STATUS: OPEN - ACCEPTABLE ACTION

RECOMMENDATION: A-81-129, September 30, 1981
AS A RESULT OF THIS SPECIAL INVESTIGATION, THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: REQUIRE THE INSTALLATION OF AN INDEPENDENTLY POWERED EVACUATION ALARM SYSTEM IN PASSENGER-CARRYING AIRCRAFT.

SOURCE OF RECOMMENDATION: UNITED AIR LINES, INC.,
DC-8 SERIES,
PHOENIX, ARIZONA,
December 29, 1980

STATUS: CLOSED - UNACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-81-130, September 30, 1981
AS A RESULT OF THIS SPECIAL INVESTIGATION, THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: PROMPTLY ADOPT THE FINAL RULE AS PROPOSED IN FAA'S NOTICE OF PROPOSED RULEMAKING NO. 81-1 — TO HAVE THE PUBLIC ADDRESS SYSTEM ON PASSENGER-CARRYING AIRCRAFT CAPABLE OF OPERATING FROM A POWER SOURCE INDEPENDENT OF THE MAIN ELECTRICAL GENERATING SYSTEM WITHOUT JEOPARDIZING THE IN-FLIGHT EMERGENCY ELECTRICAL POWER SYSTEM.

SOURCE OF RECOMMENDATION: UNITED AIR LINES, INC.,
DC-8 SERIES,
PHOENIX, ARIZONA,
December 29, 1980

STATUS: CLOSED - UNACCEPTABLE ACTION

RECOMMENDATION: A-81-131, September 30, 1981
AS A RESULT OF THIS SPECIAL INVESTIGATION, THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: AMEND THE MMEL'S FOR PASSENGER-CARRYING AIRCRAFT TO AIRCRAFT TO REQUIRE THAT THE PA SYSTEM BE OPERABLE FROM THE COCKPIT AND FROM AT LEAST ONE FLIGHT ATTENDANT STATION AT ALL TIMES. THESE AMENDMENTS SHOULD INCLUDE PROVISION THAT THE AIRCRAFT MAY CONTINUE THE FLIGHT OR SERIES OF FLIGHTS WITH OTHER PORTIONS OF THE SYSTEM INOPERATIVE FOR A REASONABLE NUMBER OF FLIGHT HOURS, BUT MAY NOT DEPART A STATION WHERE REPAIRS OR REPLACEMENTS CAN BE MADE.

SOURCE OF RECOMMENDATION: UNITED AIR LINES, INC.,
DC-8 SERIES,
PHOENIX, ARIZONA,
December 29, 1980

STATUS: CLOSED - ACCEPTABLE ACTION

[illegible]: EVACUATION/[illegible]

RECOMMENDATION: A-81-139, October 6, 1981
AS A RESULT OF SPECIAL STUDY NTSB-AAS-81-2, THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: ESTABLISH A SEPARATE SINGLE SUBPART IN 14 CFR 25 WHICH CONSOLIDATES CRASHWORTHINESS REQUIREMENTS FOR TRANSPORT CATEGORY AIRCRAFT PERTAINING TO AREAS SUCH AS CRASH MODELS, OCCUPANT PROTECTION REQUIREMENTS, EMERGENCY EGRESS, RETENTION OF ITEMS OF MASS, AND SEAT AND SEAT RESTRAINT SYSTEMS.

SOURCE OF RECOMMENDATION: STATUS: OPEN - UNACCEPTABLE ACTION

RECOMMENDATION: A-81-150, November 9, 1981
THE NTSB URGES THE BUREAU ENQUETES ACCIDENTS TO TAKE ACTION TO ACHIEVE THE FOLLOWING: REQUIRE THE INCORPORATION INTO THE EMERGENCY SECTION OF THE AIRPLANE FLIGHT MANUAL FOR AIR FRANCE CONCORDE OPERATIONS, A PROCEDURE FOR SUSPECTED/KNOWN TIRE FAILURE ON TAKEOFF WHICH INCLUDES MANDATORY REQUIREMENT TO LEAVE THE LANDING GEAR EXTENDED, TO RETURN TO THE TAKEOFF AIRFIELD, TO ADVISE THE CABIN ATTENDANTS OF INTENDED ACTION, AND TO BRIEF PASSENGERS FOR A PRECAUTIONARY LANDING.

SOURCE OF RECOMMENDATION: AIR FRANCE,
CONCORDE,
DULLES AIRPORT, VIRGINIA,
June 14, 1979

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFING

RECOMMENDATION: A-83-045, July 12, 1983
THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: SPONSOR A GOVERNMENT/INDUSTRY TASK FORCE OPEN TO FOREIGN PARTICIPANTS MADE UP OF REPRESENTATIVES FROM THE AIRPLANE MANUFACTURERS, AIR CARRIER AND COMMUTER OPERATORS, RESEARCHERS, FLIGHT ATTENDANTS, AND CONSUMERS (1) TO IDENTIFY THE TYPE OF SAFETY INFORMATION THAT IS MOST USEFUL AND NEEDED BY PASSENGERS, (2) TO IDENTIFY AND DEVELOP IMPROVED INSTRUCTIONAL CONCEPTS FOR CONVEYING THE SAFETY INFORMATION, AND (3) TO RECOMMEND APPROPRIATE CHANGES TO THE OPERATING REQUIREMENTS REGARDING PASSENGER ORAL BRIEFINGS AND INFORMATION BRIEFING CARDS.

SOURCE OF RECOMMENDATION: SPANTEX,
DC-10 SERIES,
MALAGA, SPAIN,
September 13, 1982

STATUS: OPEN - AWAIT REPLY

AVIATION SAFETY RECOMMENDATIONS ON THE TOPIC OF CREW EMERGENCY TRAINING AND CREW COORDINATION

RECOMMENDATION: A-72-069, June 28, 1972
THE FAA ESTABLISH REQUIREMENTS FOR INTERCARRIER CREW COMPOSITIONS TO AS- SURE THAT ADEQUATE TRAINING AND STANDARDIZATION OF EMERGENCY PROCEDURES HAVE BEEN ACCOMPLISHED IN ALL FACETS OF THE OPERATION.

SOURCE OF RECOMMENDATION: OVERSEAS NATIONAL AIRWAYS, INC.,
DC-9 SERIES,

SOURCE OF RECOMMENDATION: ANTILLIAANSE LUCHTVAART MAATSCHAPPIJ (ALM),
ST. CROIX, VIRGIN ISLANDS,
May 2, 1970

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: TRAINING/CREW COORDINATION

RECOMMENDATION: A-72-071, June 28, 1972
REQUIRE PERIODIC CREW TRAINING IN EVACUATION AND WET DITCHING DRILLS.

SOURCE OF RECOMMENDATION: OVERSEAS NATIONAL AIRWAYS, INC.,
DC-9 SERIES,

SOURCE OF RECOMMENDATION: ANTILLIAANSE LUCHTVAART MAATSCHAPPIJ (ALM),
ST. CROIX, VIRGIN ISLANDS,
May 2, 1970

STATUS: CLOSED - UNACCEPTABLE ACTION

RECOMMENDATION: A-72-073, June 28, 1972
ALL AIR CARRIERS MAKE A CRITICAL REVIEW OF THEIR CREW TRAINING PRACTICES AND MATERIALS WITH A VIEW TOWARD EXPANDING THEIR TRAINING IN THE AREAS OF CRASH SURVIVAL AND CREW LEADERSHIP AND ENSURING ADEQUATE RETENTION OF SUCH KNOWLEDGE.

SOURCE OF RECOMMENDATION: OVERSEAS NATIONAL AIRWAYS, INC.,
DC-9 SERIES,

SOURCE OF RECOMMENDATION: ANTILLIAANSE LUCHTVAART MAATSCHAPPIJ (ALM),
ST. CROIX, VIRGIN ISLANDS,
May 2, 1970

STATUS: CLOSED - NO LONGER APPLICABLE

TOPIC: TRAINING/CREW COORDINATION

RECOMMENDATION: A-72-130, August 28, 1972
SOME MEANS (EITHER LIGHTS OR LIGHTED SIGNS) BE INSTALLED AND USED ONTHE CV-580 FORWARD GALLEY TO ALLOW THE FLIGHT ATTENDANT VISUAL REFERENCE TO THE "NO SMOKING" SIGN. THIS WOULD INDICATE TO THE FLIGHT ATTENDANT THE NECESSITY TO SECURE HER GALLEY AND RETURN TO HER ASSIGNED SEAT.

SOURCE OF RECOMMENDATION: ALLEGHENY AIRLIENS, INC.,
580 SERIES,
NEW HAVEN, CONNECTICUT,
June 7, 1971

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-72-134, August 28, 1972
STANDARDIZED INSTRUCTIONS TO FLIGHT ATTENDANTS BE USED DURING TRAINING. THE PRACTICE OF USING THE MAIN CABIN DOOR FOR BOTH THE PLANNED AND UNPLANNED EMERGENCY TENDS TO CONFUSE THE FLIGHT ATTENDANTS. IT IS RECOMMENDED THAT THE SEQUENCE AND PROCEDURE FOR A PLANNED PRACTICE EMERGENCY BE IDENTICAL TO THAT WHICH IS TO BE USED IN ACTUAL EMERGENCY. IT IS FURTHER RECOMMENDED THAT THE ALLEGHENY AIRLINES HOSTESS MANUAL BE REVISED ACCORDINGLY.

SOURCE OF RECOMMENDATION: ALLEGHENY AIRLIENS, INC.,
580 SERIES,
NEW HAVEN, CONNECTICUT,
June 7, 1971

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: TRAINING/CREW COORDINATION

RECOMMENDATION: A-73-015, May 18, 1973
THE FEDERAL AVIATION ADMINISTRATION BRING THIS ACCIDENT TO THE ATTENTION OF APPROPRIATE FAA AND AIR CARRIER PERSONNEL. ESTABLISHED PILOT TRAINING PROGRAMS AND OPERATIONS MANUALS SHOULD BE REVISED TO INCLUDE GUIDANCE ON TIME AND TASK SHARING IN ABNORMAL AND EMERGENCY SITUATIONS. EMPHASIS SHOULD BE PLACED ON THE NEED OF PREPLANNING TASK AND TIME SHARING BY THE CREW BEFORE AN UNUSUAL OR EMERGENCY SITUATION ARISES.

SOURCE OF RECOMMENDATION: MOHAWK AIRLINES INC.,
FH-227B SERIES,
ALBANY, NEW YORK,
March 3, 1972

STATUS: CLOSED - UNACCEPTABLE ACTION

RECOMMENDATION: A-74-114, January 5, 1975
AMEND 14 CFR 121.417(C)(4) TO ELIMINATE THE PROVISION WHICH PERMITS CARRIERS TO USE DEMONSTRATIONS ALONE TO TRAIN CREWMEMBERS FOR CERTAIN EMERGENCY SITUATIONS, THUS REQUIRING PERFORMANCE OF DRILLS IN THE OPERATION AND USE OF EMERGENCY EXITS.

SOURCE OF RECOMMENDATION: AAS-74-3, January 5, 1975

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: TRAINING/CREW COORDINATION

RECOMMENDATION: A-75-084, November 23, 1975
REQUIRE AIR CARRIERS TO COMPLY WITH THE PROVISIONS OF 14 CFR 121.417(C) (4) BY THE USE OF ACCURATE AND REALISTIC EQUIPMENT AND PROCEDURES WHICH ACCURATELY SIMULATE EMERGENCY CONDITIONS, INCLUDINGTHE FORCES INVOLVED IN OPENING EXITS IN THE EMERGENCY MODE; AND REQUIRE THAT DURING EACH FLIGHT ATTENDANT'S INITIAL AND RECURRENT TRAINING HE OPERATE EMERGENCY EXITS WHICH DUPLICATE THE FORCES ENCOUNTERED AND ACTIONS NECESSARY WHEN SUCH EXITS ARE OPENED IN THE EMERGENCY MODE.

SOURCE OF RECOMMENDATION: WESTERN AIR LINES, INC.,
737 SERIES,
CASPER, WYOMING,
March 31, 1975

STATUS: OPEN - ACCEPTABLE ACTION

RECOMMENDATION: A-76-024, April 29, 1976
REQUIRE THAT OPERATORS OF AIRCRAFT HAVING THE CHEMICALLY GENERATED PASSENGER SUPPLEMENTAL OXYGEN SYSTEMS INCLUDE DETAILED INFORMATION REGARDING THE OPERATIONAL CHARACTERISTICS OF THESE SYSTEMS IN THE TRAINING PROGRAMS FOR THEIR COCKPIT AND CABIN CREWMEMBERS. SUCH INFORMATION SHOULD INCLUDE FLOW RATES AND THE TIME AND VOLUME LAG INTHE DELIVERY OF OXYGEN. (CLASS II - PRIORITY FOLLOWUP)

SOURCE OF RECOMMENDATION: DC-10 SERIES,

SOURCE OF RECOMMENDATION: L-1011 SERIES,
April 29, 1976

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: TRAINING/CREW COORDINATION

RECOMMENDATION: A-76-073, June 9, 1976
REQUIRE MODIFICATION OF CONTINENTAL AIR LINES' FLIGHTCREW EMERGENCY EVACUATION TRAINING PROGRAM TO INSURE THAT ADEQUATE EMPHASIS IS PLACED ON THE ASPECTS OF CREW COORDINATION, TEAM EFFORT, AND AWARENESS OF INDIVIDUAL CREWMEMBER'S RESPONSIBILITIES AS LEADERS OF AN EVACUATION.

SOURCE OF RECOMMENDATION: CONTINENTAL AIRLINES, INC.,
727 SERIES,
DENVER, COLORADO,
August 7, 1975

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-76-074, June 9, 1976
ISSUE AN AIR CARRIER OPERATIONS BULLETIN TO REQUIRE THAT PRINCIPAL OPERATIONS INSPECTORS REVIEW THE EMERGENCY EVACUATION TRAINING PROGRAMS OF THEIR ASSIGNED AIR CARRIERS TO INSURE THAT ADEQUATE EMPHASIS IS PLACED ON THE ASPECTS OF CREW COORDINATION, TEAM EFFORT,AND AWARENESS OF INDIVIDUALS' RESPONSIBILITIES AS LEADERS OF AN EVACUATION.

SOURCE OF RECOMMENDATION: CONTINENTAL AIRLINES, INC.,
727 SERIES,
DENVER, COLORADO,
August 7, 1975

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: TRAINING/CREW COORDINATION

RECOMMENDATION: A-76-075, June 9, 1976
REQUIRE THAT THE FLIGHTCREW MANUALS AND THE FLIGHT ATTENDANT MANUALSOF ALL AIR CARRIERS INCLUDE THE EVACUATION DUTY ASSIGNMENTS OF THE ENTIRE CREW.

SOURCE OF RECOMMENDATION: CONTINENTAL AIRLINES, INC.,
727 SERIES,
DENVER, COLORADO,
August 7, 1975

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-76-132, October 7, 1976
AMEND 14 CFR 121.584 TO INCLUDE PROVISIONS RELEVANT TO CARRIAGE OF MENTAL PATIENTS WHO ARE POTENTIALLY DANGEROUS TO THEMSELVES OR TO OTHERS. THESE PROVISIONS SHOULD INCLUDE THE REQUIREMENT THAT THE MENTAL PATIENT BE ACCOMPANIED BY A QUALIFIED MEDICAL ATTENDANT.

SOURCE OF RECOMMENDATION: EASTERN AIR LINES, INC.,
L-1011 SERIES,
SAN JUAN,
July 16, 1976

STATUS: OPEN - ACCEPTABLE ALTERNATE ACTION

TOPIC: TRAINING/CREW COORDINATION

RECOMMENDATION: A-76-133, October 7, 1976
AMEND ADVISORY CIRCULAR 121-18 TO PROVIDE GUIDANCE TO ORGANIZATIONS AND PERSONS RESPONSIBLE FOR THE TRANSPORTATION MENTAL PATIENTS WITH REGARD TO THE ACTIONS NECESSARY AND THE RESPONSIBILITIES INVOLVED IN ESCORTING SUCH PERSONS.

SOURCE OF RECOMMENDATION: EASTERN AIR LINES, INC.,
L-1011 SERIES,
SAN JUAN,
July 16, 1976

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-77-026, May 23, 1977
REQUIRE THAT THE EMERGENCY EVACUATION TRAINING PROGRAM OF ALL DC-9 OPERATORS COMPLY WITH THE INTENT OF 14 CFR 121.417, SPECIFICALLY WITH REGARD TO TRAINING IN THE OPERATION OF THE TAIL CONE EXIT.

SOURCE OF RECOMMENDATION: TEXAS INTERNATIONAL AIRLINES, INC.,
DC-9 SERIES,
DENVER, COLORADO,
November 16, 1976

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: TRAINING/CREW COORDINATION

RECOMMENDATION: A-79-035, June 1, 1979
ISSUE AN AIR CARRIER OPERATIONS BULLETIN REQUESTING PRINCIPAL OPERATIONS INSPECTORS TO INSURE THAT AIR CARRIER TRAINING PROGRAMS INCLUDE INSTRUCTIONS TO CREWMEMBERS WITH RESPECT TO THE AVAILABILITY, CAPABILITIES, AND USE OF FLOTABLE SEAT CUSHIONS ON THEIR AIRCRAFT.

SOURCE OF RECOMMENDATION: NATIONAL AIRLINES, INC.,
727 SERIES,
ESCAMBIA BAY, PENSACOLA, FLORIDA,
May 8, 1978

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-79-066, August 24, 1979
THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: ISSUE AN AIR CARRIER OPERATIONS BULLETIN WHICH WILL PROVIDE GUIDANCE AND CRITERIA TO FAA INSPECTORS IN DETERMINING THE SCOPE, QUALITY, AND EFFECTIVENESS OF TRAINING PROGRAMS WITH RESPECT TO COMMUNICATION AND COORDINATION AMONG CREWMEMBERS.

SOURCE OF RECOMMENDATION: UNITED AIR LINES, INC.,
DC-8 SERIES,
PORTLAND, OREGON,
December 28, 1978

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: TRAINING/CREW COORDINATION

RECOMMENDATION: A-81-061, June 3, 1981
THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATON: REQUIRE THAT AIR CARRIERS OPERATING APPLICABLE BOEING 727 AIRCRAFT INCLUDE EMERGENCY PROCEDURES FOR OPERATION OF THE VENTRAL AIRSTAIR DOOR IN THEIR TRAINING PROGRAMS FOR CABIN CREWS.

SOURCE OF RECOMMENDATION: CONTINENTAL AIRLINES/AIR MICRONESIA, INC.,
727 SERIES,
YAP, WESTERN CAROLINE ISL, CAROLINE ISLANDS,
November 21, 1980

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-81-127, September 21, 1981
THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: REVIEW DC-10 OPERATOR TRAINING PROGRAMS FOR FLIGHT ATTENDANT PERSONNEL AND FLIGHTCREWS TO ASSURE THAT THEY INCLUDE A DESCRIPTION AND DISCUSSION OF THE GALLEY LIFT SYSTEM INCLUDING THE ELECTRICAL CIRCUITRY, LOCATION OF CIRCUIT BREAKERS, FUNCTION OF DOOR INTERLOCK SWITCHES, AND EMERGENCY OPERATING PROCEDURES.

SOURCE OF RECOMMENDATION: WORLD AIRWAYS, INC.,
DC-10 SERIES,
BWI AIRPORT, BALTIMORE, MARYLAND,
September 19, 1981

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: TRAINING/CREW COORDINATION

RECOMMENDATION: A-81-151, November 9, 1981
THE NTSB URGES THE BUREAU ENQUETES ACCIDENTS TO TAKE ACTION TO ACHIEVE THE FOLLOWING: DIRECT THE DEVELOPMENT AND ADOPTION BY AIR FRANCE OF TRAINING PLANS WHICH STRESS FLIGHT AND CABIN CREW COORDINATION PRIOR TO PRECAUTIONARY OR ABNORMAL LANDINGS.

SOURCE OF RECOMMENDATION: AIR FRANCE,
CONCORDE,
DULLES AIRPORT, VIRGINIA,
June 14, 1979

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-82-098, August 26, 1982
THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: ISSUE AN AIR CARRIER OPERATIONS BULLETIN REQUIRING PRINCIPAL OPERATIONS INSPECTORS TO REVIEW AND TO REQUIRE AS NECESSARY, MODIFICATION OF, THE OPERATIONS MANUALS OF ALL AIR CARRIERS TO ASSURE SAFE AND EFFECTIVE COORDINATION BETWEEN FLIGHT AND CREW. THE FOLLOWING SAFE OPERATING PROCEDURES SHOULD BE ADDRESSED:

(1) FLIGHT CREW PREDEPARTURE BRIEFINGS OF THE SENIOR FLIGHT ATTENDANT TO INCLUDE FORECAST TURBULENCE-RELATED WEATHER CONDITIONS, SCHEDULING OF CABIN SERVICES AND CLEANUP, AND SECURING OF GALLEYS, CABIN, AND PASSENGERS.

(2) FLIGHT CREW PUBLIC ADDRESS ANNOUNCEMENTS TO FOREWARN FLIGHT ATTENDANTS AND PASSENGERS OF ANTICIPATED IN-FLIGHT TURBULENCE AND TO REQUIRE FLIGHT ATTENDANTS TO CEASE IN-FLIGHT SERVICE AND TO BE SEATED WITH THEIR RESTRAINTS FASTENED WHEN TURBULENCE PENETRATION IS EXPECTED AND THE INTENSITY IS FORECAST TO BE "MODERATE" OR GREATER, AS DEFINED IN AVIATION WEATHER SERVICE, AC 00-45B, OR WHEN TURBULENCE IS ENCOUNTERED.

SOURCE OF RECOMMENDATION: UNITED AIRLINES,
737,
NEWPORT NEWS, VIRGINIA,
February 10, 1981

STATUS: OPEN - ACCEPTABLE ACTION

AVIATION SAFETY RECOMMENDATIONS ON THE TOPIC OF IN-FLIGHT AND POST-CRASH FIRE

RECOMMENDATION: AUGUST 31, 1959,
IMPROVED LIGHTENING PROTECTION

SOURCE OF RECOMMENDATION: TRANS WORLD AIRLINES
L-1649A MILAN, ITALY, 1959
CAPITOL AIRWAYS VISCOUNT
CHASE, MD.
MAY 12, 1959

STATUS: CLOSED

TOPIC: FIRE

RECOMMENDATION: MARCH 3, 1961, AND JANUARY 2, 1962,
IMPROVED POWERPLANT FIRE PROTECTION, FURTHER RESEARCH FOR CRASH FIRE PROTECTION, AND INDUSTRY TO EXAMINE CRASH FIRE PROTECTION METHODS.

SOURCE OF RECOMMENDATION: CAPITOL AIRWAYS
C-46F
KATA, TEXAS
JANUARY 22, 1961

STATUS: CLOSED

TOPIC: FIRE

RECOMMENDATION: 4-RE-33, DECEMBER 17, 1963,
PROVIDE IMPROVED LIGHTENING PROTECTION, INSTALL STATIC DISCHARGE WICKS ON ALL TURBINE-POWERED AIRCRAFT, FAA REEVALUATE PROBLEMS ASSOCIATED WITH INCORPORATING FLAME ARRESTORS IN FUEL TANK VENT OUTLETS, LIMIT FUEL TO JET-A, ELIMINATE FLAMMABLE AIR/VAPOR MIXTURES FROM FUEL TANKS BY AN INERT GAS OR SUFFICIENT AIR CIRCULATION TO MAINTAIN TOO LEAN A MIXTURE FOR COMBUSTION.

SOURCE OF RECOMMENDATION: PAN AMERICAN AIRWAYS
B-707
ELKTON, MD
DECEMBER 8, 1963

STATUS: CLOSED

RECOMMENDATION: 4-RE-40, JANUARY 20, 1964,
FASTER COMPLIANCE WITH AD-64-6-1
(ISSUED FEBRUARY 17, 1964) FOR COMPLIANCE WITH
MAINTENANCE BULLETIN (WITH REGARD TO CABIN WALL
INFLIGHT FIRE).

SOURCE OF RECOMMENDATION: UNITED AIRLINES
B-720
PORTLAND, OREGON
OCTOBER 1, 1964

STATUS: CLOSED

TOPIC: FIRE

RECOMMENDATION: 4-RE-55, APRIL 8, 1965,
EXPEDITE FAA APPROVAL AND MANDATORY
REQUIREMENT OF A FUEL SURGE TANK DETECTION
AND SUPPRESSION SYSTEM FOR B-707.

SOURCE OF RECOMMENDATION: TRANS WORLD AIRLINES
B-707-331,
ROME, ITALY
NOVEMBER 23, 1964

STATUS: CLOSED

TOPIC: FIRE

RECOMMENDATION: 5-RE-17, OCTOBER 9, 1964,
EVALUATE THE DESIGN OF THE PYRENE DUO
HEAD MODEL DCD-10 FIRE EXTINGUISHER SYSTEM
AND TAKE SUCH CORRECTIVE ACTION AS WILL
INCREASE ITS RELIABILITY AND PREVENT RELEASE
OF CO_2 INTO THE HABITABLE PORTIONS OF THE AIRCRAFT.

SOURCE OF RECOMMENDATION: UNITED AIRLINES
VISCOUNT
PARROTTSVILLE, TN
JULY 9, 1964

STATUS: CLOSED

RECOMMENDATION: 6-RE-25, NOVEMBER 30, 1965,

- o REROUTE FUEL LINES TO PASS THROUGH FLOOR BEAMS NEAR THE CENTERLINE OF THE AIRCRAFT.
- o FUEL LINES AND SHROUDS SHOULD BE MADE OF STAINLESS STEEL AND SHOULD HAVE A WALL THICKNESS OF SUFFICIENT DIMENSION TO WITHSTAND RATHER SEVERE IMPACTS. WE SUGGEST THAT WALL THICKNESS BE NOT LESS 0.040 INCH.
- o THE GENERATOR LEADS SHOULD BE ROUTED SO THAT THERE IS MAXIMUM SEPARATION BETWEEN THESE LEADS AND THE FUEL LINES. EACH LEAD SHOULD BE IN A SEPARATE PLASTIC CONDUIT WITH SUITABLE STRENGTH AND FLEXIBILITY TO WITHSTAND BENDING AND REASONABLY HIGH TENSILE STRENGTH.
- o ALL OTHER SIMILARLY CONFIGURED AIRCRAFT (E.G., DC-9, LEAR JET, CARAVELLE, BAC-111, JET COMMANDER) BE STUDIED TO DETERMINE WHETHER OR NOT ANALOGOUS DANGERS EXIST IN THEIR FUEL AND ELECTRICAL SYSTEMS.

SOURCE OF RECOMMENDATIONS: UNITED AIRLINES
B-727
SALT LAKE CITY, UTAH
NOVEMBER 11, 1965

STATUS: CLOSED

TOPIC: FIRE

RECOMMENDATION: 6-RE-31, DECEMBER 16, 1965,

- o REQUIRE NEWLY CERTIFICATED AIRCRAFT BE FITTED WITH NEWER MATERIALS LESS SUSCEPTIBLE TO COMBUSTION.
- o ENCOURAGE AIR CARRIERS TO USE THESE MATERIALS WHEN THEY REFURNISH THEIR AIRPLANES. (IN THIS ACCIDENT 43 of 91 PERSONS DIED FROM SUFFOCATION FROM BURNING CABIN MATERIALS).

SOURCE OF RECOMMENDATION: UNITED AIR LINES
B-727
SALT LAKE CITY, UTAH
NOVEMBER 11, 1965

STATUS: CLOSED

RECOMMENDATION: 5-RE-55, APRIL 8, 1965,
REORIENT FAA'S LIGHTENING STUDY
GROUP TO CONSIDER ALL FUEL SYSTEM
HAZARDS.

SOURCE OF RECOMMENDATION: TRANS WORLD AIRLINES
B-707-331,
ROME, ITALY
NOVEMBER 23, 1964

STATUS: CLOSED

RECOMMENDATION: A-67-022, July 25, 1967
IT IS RECOMMENDED THAT A FIREPROF BARRIER OF APPROPRIATE WIDTH BE PROVIDED AT THE FUSELAGE TOP SKIN BETWEEN FUSELAGE STATIONS 936 AND 958. ALSO, IT IS RECOMMENDED THAT THE ALUMINUM ALLOY WALL SEPARATINGTHE HYDRAULIC BAY AND THE APU AIR INTAKE PLENIUM CHAMBER BE REPLACEDWITH SUITABLE FIREPROOF MATERIAL. AS OF THIS TIME WE HAVE NOT IDENTIFIED THE IGNITION SOURCE OF THE INFLIGHT FIRE; HOWEVER,ALL POSSIBLE SOURCES ARE BEING CONSIDERED. IN THIS CATEGORY, AN OBVIOUS POSSIBLE SOURCE OF HEAT AND FLAME IN THE FIRE AREA IS THE AUXILIARY POWER UNIT. ALTHOUGH OUR EVIDENCE DOES NOT POINT TO THE APU AS A SOURCE OF IGNITION, AS A PRECAUTIONARY MEASURE IS RECOMMENDED THAT, UNTIL SUCH TIME AS SUITABLE BARRIERS AS RECOMMENDED ABOVE ARE PROVIDED, INFLIGHT USE OF THE APU BE RESTRICTED.

SOURCE OF RECOMMENDATION: MOHAWK AIRLINES INC.,
1-11 SERIES,
PLOSSBURG, PENNSYLVANIA,
June 23, 1967

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: FIRE

RECOMMENDATION: A-67-033, November 9, 1967
IT IS RECOMMENDED THAT A REEVALUATION OF THE ADEQUACY OF THE APU EXHAUST DUCT AND SHROUD MOUNTING INSTALLATION ON DC-9 AIRCRAFT BE MADE AND THAT THE IMPLEMENTATION OF ANY DESIGN OR INSTALLATION CHANGES THAT MAY RESULT BE MADE MANDATORY. WE FURTHER RECOMMEND THATTHE APU NOT BE OPERATED IN FLIGHT UNTIL THE REEVALUATION AND ANY NECESSARY MODIFICATIONS ARE COMPLETED.

SOURCE OF RECOMMENDATION: DELTA AIR LINES, INC.,
DC-9 SERIES,
October 5, 1967

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-67-035, December 29, 1967
1. THAT COMPLIANCE WITH PRATT & WHITNEY TURBOJET SERVICE BULLETIN NO. 1158 BE MADE MANDATORY AT THE EARLIEST DATE PRACTICAL ON JT8D ENGINES NOT SO MODIFIED AT MANUFACTURE.
2. THAT THE ADEQUACY OF THE POWERPLANT FIRE WARNING SYSTEM BE REEVALUATED RELATIVE TO THE PROBLEMS ASSOCIATED WITH FAN DUCT FIRES.

SOURCE OF RECOMMENDATION: NORTHWEST AIRLINES, INC.,
727 SERIES,
MILWAUKEE, WISCONSIN,
October 17, 1967

STATUS: CLOSED - ACCEPTABLE ACTION

OPIC: FIRE

RECOMMENDATION: A-68-017, July 5, 1968
WE RECOMMEND THAT CONSIDERATION BE GIVEN TO RELOCATING THE TRANSFER SWITCHES ON THE FIRE CONTROL PANEL ON BOEING 707-720 AIRCRAFT TO PRECLUDE THE POSSIBILITY OF INADVERTENT MOVEMENT OF THE FIRE HANDLESDURING AN EMERGENCY. AS AN INTERIM MEASURE, WE FURTHER RECOMMEND THAT A NOTICE BE ISSUED BY APPROPRIATE MEANS TO ALL OPERATORS OF THIS SERIES AIRCRAFT POINTING OUT THE POSSIBILITY OF UNINTENDED ACTUATION OF THE FIRE HANDLES WHEN SELECTING THE FIRE EXTINGUISHER TRANSFER SWITCH.

SOURCE OF RECOMMENDATION: BRITISH OVERSEAS AIRWAYS CORPORATION,
707 SERIES,
LONDON, ENGLAND,
April 4, 1968

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-69-015, June 23, 1969
TO ENSURE PROPER OPERATION OF THE FIRE EXTINGUISHER SYSTEMS AT ALL TIMES THE BOARD RECOMMENDED: A. THE PROVISIONS OF SERVICE BULLETIN 26-04 BE MADE THE BASIS OF AN AIRWORTHINESS DIRECTIVE. B. UNTIL SUCHTIME AS THE MODIFICATION IS MADE, THE GAS PORT AREAS BE INSPECTED FOR RESTRICTION AFTER EACH DISCHARGE OF THE FIRE EXTINGUISHER CONTAINER.

SOURCE OF RECOMMENDATION: EASTERN AIR LINES, INC.,
727 SERIES,
MIAMI, FLORIDA,
March 16, 1969

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: FIRE

RECOMMENDATION: A-71-059, November 12, 1971
THE FEDERAL AVIATION ADMINISTRATION INITIATE ACTION TO INCOR- PORATE IN ITS AIRWORTHINESS REQUIREMENTS, A PROVISION FOR FUEL SYSTEM FIRE SAFETY DEVICES WHICH WILL BE EFFECTIVE IN THE PREVENTION AND CONTROL OF BOTH IN-FLIGHT AND POSTCRASH FUEL SYSTEM FIRES AND EXPLOSIONS. IT IS FURTHER RECOMMENDED THAT RULEMAKING ACTION IN THIS MATTER SPECIFICALLY APPLY TO FUTURE PASSENGER-CARRYING AIRCRAFT IN THE TRANSPORT CATEGORY, AND THAT CONSIDERATION BE GIVEN TO AN ADAPTATION TO ALL OTHER PASSENGER-CARRYING AIRCRAFT NOW IN SERVICE.

SOURCE OF RECOMMENDATION: ALLEGHENY AIRLIENS, INC.,
580 SERIES,
NEW HAVEN, CONNECTICUT,
June 7, 1971

STATUS: OPEN - ACCEPTABLE ACTION

RECOMMENDATION: A-72-060, June 16, 1972
THE FEDERAL AVIATION ADMINISTRATION, IN COOPERATION WITH THE AIRCRAFT MANUFACTURERS AND THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, UTILIZE THE RESULTS OF ALREADY EXTENSIVE RESEARCH AND ACCIDENT INVESTIGATION DATA TO DEVELOP AND IMPLEMENT MAJOR IMPROVEMENTS IN THE DESIGN OF TRANSPORT AIRCRAFT INTERIORS. OF PARTICULAR CONCERN ARE IMPROVEMENTS IN THE CRASHWORTHINESS OF GALLEY EQUIPMENT, STEWARDESS SEATS AND RESTRAINING DEVICES, AND THE FLAMMABILITY CABIN INTERIOR MATERIALS.

SOURCE OF RECOMMENDATION: CAPITOL INTERNATIONAL AIRWAYS, INC.,
DC-8 SERIES,
ANCHORAGE, ALASKA,
November 27, 1970

STATUS: OPEN - ACCEPTABLE ACTION

TOPIC: . RE

RECOMMENDATION: A-72-170, October 6, 1972
ISSUE A MAINTENANCE BULLETIN DIRECTING INSPECTORS TO INFORM OPERATORS OF THE FACTS AND CIRCUMSTANCES INVOLVED IN THIS ACCIDENT SO THAT OPERATORS CAN TAKE APPROPRIATE CORRECTIVE ACTION.

SOURCE OF RECOMMENDATION: EASTERN AIR LINES, INC.,
DC-9 SERIES,
ATLANTA, GEORGIA,
May 10, 1972

/

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-73-042, June 25, 1973
AMEND 14 CFR 25.812 TO REQUIRE EXIT SIGN BRIGHTNESS AND GENERAL ILLUMINATION LEVELS IN THE PASSENGER CABIN THAT ARE CONSISTENT WITH THOSE NECESSARY TO PROVIDE ADEQUATE VISIBILITY IN CONDITIONS OF DENSE SMOKE.

SOURCE OF RECOMMENDATION: NORTH CENTRAL AIRLINES, INC.,
DC-9 SERIES,

SOURCE OF RECOMMENDATION: UNITED AIR LINES, INC.,
737 SERIES,

SOURCE OF RECOMMENDATION: EASTERN AIR LINES, INC.,
L-1011 SERIES,
CHICAGO, ILLINOIS,
December 20, 1972

STATUS: CLOSED - UNACCEPTABLE ACTION

TOPIC: FIRE

RECOMMENDATION: A-73-067, September 5, 1973
REQUIRE A MEANS FOR EARLY DETECTION OF LAVATORY FIRES ON ALL TURBINE-POWERED, TRANSPORT-CATEGORY AIRCRAFT OPERATED UNDER PART 121OF THE FEDERAL AVIATION REGULATIONS, SUCH AS SMOKE DETECTORS OR OPERATING PROCEDURES FOR THE FREQUENT INSPECTION OF LAVATORIES BY CABIN ATTENDANTS.

SOURCE OF RECOMMENDATION: VARIG,
707 SERIES,
PARIS, FRANCE,
July 11, 1973

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-73-068, September 5, 1973
REQUIRE EMERGENCY OXYGEN BOTTLES WITH FULL-FACE SMOKE MASKS FOR EACH CABIN ATTENDANT ON TURBINE-POWER TRANSPORT AIRCRAFT IN ORDER TO PERMIT THE ATTENDANTS TO COMBAT LAVATORY AND CABIN FIRES.

SOURCE OF RECOMMENDATION: VARIG,
707 SERIES,
PARIS, FRANCE,
July 11, 1973

STATUS: OPEN - ACCEPTABLE ACTION

TOPIC: FIRE

RECOMMENDATION: A-73-069, September 5, 1973
REEVALUATE CERTIFICATION COMPLIANCE WITH SECTION 4B.381(D) OF THE CIVIL AIR REGULATIONS ON BOEING 707 SERIES AIRCRAFT.

SOURCE OF RECOMMENDATION: VARIG,
707 SERIES,
PARIS, FRANCE,
July 11, 1973

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-73-070, September 5, 1973
ORGANIZE A GOVERNMENT/INDUSTRY TASK FORCE ON AIRCRAFT FIRE PREVENTION TO REVIEW DESIGN CRITERIA AND FORMULATE SPECIFIC MODIFICATIONS FOR IMPROVEMENTS WITH RESPECT TO THE FIRE POTENTIAL OF SUCH ENCLOSED AREAS AS LAVATORIES IN TURBINE-POWERED AIRCRAFT OPERATING UNDER THE PROVISIONS OF PART 121 OF THE FEDERAL AVIATION REGULATIONS.

SOURCE OF RECOMMENDATION: VARIG,
707 SERIES,
PARIS, FRANCE,
July 11, 1973

STATUS: OPEN - ACCEPTABLE ACTION

TOPIC: FIRE

RECOMMENDATION: A-73-119, January 10, 1974
TAKE IMMEDIATE STEPS TO DETERMINE WHETHER THE PRESENT SMOKE CHUTE INSTALLATION ON BOEING 707 CARGO AND CARGO- PASSENGER AIRCRAFT SATISFIES THE PROVISIONS OF FAR 25. 855 AND 25.857.

SOURCE OF RECOMMENDATION: PAN AMERICAN WORLD AIRWAYS, INC.,
707 SERIES,
BOSTON, MASSACHUSETTS,
November 3, 1973

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-73-120, January 10, 1974
EFFECT RETROACTIVE MODIFICATIONS ON ALL SUBJECT AIRCRAFT TO ENSURE FULL COMPLIANCE WITH PROVISIONS OF FAR 25.855 AND 25.857 PERTAINING TO PREVENTION OF HAZARDOUS QUANTITIES OF SMOKE, FLAMES, OR NOXIOUS GASES FROM ENTERING THE FLIGHTCREW COMPARTMENT.

SOURCE OF RECOMMENDATION: PAN AMERICAN WORLD AIRWAYS, INC.,
707 SERIES,
BOSTON, MASSACHUSETTS,
November 3, 1973

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: FIRE

RECOMMENDATION: A-73-121, January 10, 1974
PROVIDE OPERATORS OF THE SUBJECT AIRCRAFT WITH DATA TO ENABLE FLIGHTCREWS TO IDENTIFY SMOKE SOURCES, AND REQUIRE OPERATORS TO ESTABLISH PROCEDURES IN THEIR OPERATING MANUALS TO CONTROL AND EVACUATE SMOKE EFFECTIVELY DURING THE SPECIFIC FLIGHT REGIMES.

SOURCE OF RECOMMENDATION: PAN AMERICAN WORLD AIRWAYS, INC.,
707 SERIES,
BOSTON, MASSACHUSETTS,
November 3, 1973

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-73-122, January 10, 1974
REEVALUATE PREVIOUS SMOKE EVACUATION TESTS CONDUCTED DURING CERTIFICATION RELATIVE TO THE QUANTITY AND SOURCE OF SMOKE AS APPLICABLE TO SMOKE EVACUATION PROCEDURES CURRENTLY EMPLOYED BY OPERATORS OF BOEING 707 AIRCRAFT.

SOURCE OF RECOMMENDATION: PAN AMERICAN WORLD AIRWAYS, INC.,
707 SERIES,
BOSTON, MASSACHUSETTS,
November 3, 1973

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: FIRE

RECOMMENDATION: A-74-005, February 6, 1974
REQUIRE THAT TRANSPORT CATEGORY AIRPLANES CERTIFICATED UNDER PART 4B OF THE CIVIL AIR REGULATIONS PRIOR TO THE EFFECTIVE DATE OF AMENDMENT 4B-8 COMPLY WITH PART 25.1439 OF THE FEDERAL AVIATION REGULATIONS;

SOURCE OF RECOMMENDATION: PAN AMERICAN WORLD AIRWAYS, INC.,
707 SERIES,
BOSTON, MASSACHUSETTS,
November 3, 1973

STATUS: OPEN - ACCEPTABLE ACTION

RECOMMENDATION: A-74-006, February 6, 1974
REQUIRE THAT A ONE-TIME INSPECTION BE MADE OF ALL SMOKE GOGGLES PROVIDED FOR THE FLIGHTCREW OF ALL TRANSPORT CATEGORY AIRPLANES TO ASSURE THAT THESE GOGGLES CONFORM TO THE PROVISIONS OF PART 25.1439 OF THE FEDERAL AVIATION REGULATIONS.

SOURCE OF RECOMMENDATION: PAN AMERICAN WORLD AIRWAYS, INC.,
707 SERIES,
BOSTON, MASSACHUSETTS,
November 3, 1973

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: FIRE

RECOMMENDATION: A-74-020, March 26, 1974
CONDUCT A COMPREHENSIVE INSPECTION OF EACH AIR CARRIER'S PROCEDURES FOR COMPLIANCE WITH 14 CFR 103 AND 14 CFR 121.433(A), SPECIFICALLY WITH REGARD TO RECEIVING, PALLETIZING, CONSOLIDATING, AND AIRCRAFT LOADING, AS WELL AS THE RELATED TRAINING. THIS INSPECTION SHOULD BE COMPLETED AT THE EARLIEST POSSIBLE DATE AND NOT LATER THAN 60 DAYS FROM THE DATE OF THIS RECOMMENDATION.

SOURCE OF RECOMMENDATION: PAN AMERICAN WORLD AIRWAYS, INC.,
707 SERIES,
BOSTON, MASSACHUSETTS,
November 3, 1973

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-74-021, March 26, 1974
DEVELOP, IN COOPERATION WITH THE DEPARTMENT OF TRANSPORTATION, OFFICE OF HAZARDOUS MATERIALS, A COMPLIANCE CHECKLIST TO DETERMINE WHETHER OR NOT A SHIPMENT CONFORMS TO FEDERAL HAZARDOUS MATERIALS REGULATIONS. THIS CHECKLIST SHOULD BE CIRCULATED TO ALL INVOLVED AGENCIES AND ORGANIZATIONS.

SOURCE OF RECOMMENDATION: PAN AMERICAN WORLD AIRWAYS, INC.,
707 SERIES,
BOSTON, MASSACHUSETTS,
November 3, 1973

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: FIRE

RECOMMENDATION: A-74-022, March 26, 1974
DEVELOP AND DISSEMINATE INFORMATION ABOUT FEDERAL REGULATIONS WHICH APPLY TO AIR CARRIAGE OF HAZARDOUS MATERIALS TO THE AIR CARRIERS' MARKETING OR SALES REPRESENTATIVES AND THEIR APPOINTED AGENTS.

SOURCE OF RECOMMENDATION: PAN AMERICAN WORLD AIRWAYS, INC.,
707 SERIES,
BOSTON, MASSACHUSETTS,
November 3, 1973

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-74-023, March 26, 1974
AMEND 14 CFR 121.597 TO REQUIRE THE PERSON AUTHORIZED TO EXERCISE OPERATIONAL CONTROL OVER THE FLIGHT IN THE CASE OF SUPPLEMENTAL AIR CARRIERS AND COMMERCIAL OPERATORS OF LARGE AIRCRAFT TO INFORM THE CAPTAIN OF ANY DANGEROUS ARTICLES ABOARD THE FLIGHT, AS OUTLINED IN 14 CFR 103.25. FURTHER, AMEND 14 CFR 121.601 TO MAKE THE DISPATCHER RESPONSIBLE IN THE CASE OF SCHEDULED AIR CARRIERS, FOR INFORMING THE CAPTAIN OF DANGEROUS ARTICLES ABOARD THE FLIGHT, IN ADDITION TO THE NOTIFICATION REQUIRED BY 14 CFR 103.25.

SOURCE OF RECOMMENDATION: PAN AMERICAN WORLD AIRWAYS, INC.,
707 SERIES,
BOSTON, MASSACHUSETTS,
November 3, 1973

STATUS: CLOSED - ACCEPTABLE ALTERNATE ACTION

TOPIC: FIRE

RECOMMENDATION: A-74-024, March 26, 1974
AMEND 14 CFR 135 TO REQUIRE EACH OPERATOR UNDER THIS PART TO DEVELOPPROCEDURES TO INSURE THAT THE CAPTAIN IS INFORMED OF ANY DANGEROUS ARTICLES ABOARD. THIS NOTIFICATION SHOULD CONTAIN THE INFORMATION OUTLINED IN 14 CFR 103.25.

SOURCE OF RECOMMENDATION: PAN AMERICAN WORLD AIRWAYS, INC.,
707 SERIES,
BOSTON, MASSACHUSETTS,
November 3, 1973

STATUS: CLOSED - ACCEPTABLE ALTERNATE ACTION

RECOMMENDATION: A-74-025, March 26, 1974
RESCIND THE PROVISION IN 14 CFR 103.3(A) WHICH ALLOWS THE AIRCRAFT OPERATOR TO RELY ON THE SHIPPER'S STATEMENT AS PRIMA FACIE EVIDENCETHAT THE SHIPMENT COMPLIES WITH THE REQUIREMENTS OF THIS PART. INSTEAD, REQUIRE THE AIR CARRIER TO INSTITUTE A MONITORING SYSTEM TO ASSURE THAT ALL DANGEROUS ARTICLES SHIPPED BY AIR ARE INSPECTED AGAINST ALL REGULATORY SAFETY CONTROLS WHICH CAN BE VERIFIED AT THE AIR CARRIERS RECEIVING POINT.

SOURCE OF RECOMMENDATION: PAN AMERICAN WORLD AIRWAYS, INC.,
707 SERIES,
BOSTON, MASSACHUSETTS,
November 3, 1973

STATUS: CLOSED - ACCEPTABLE ALTERNATE ACTION

TOPIC: FIRE

RECOMMENDATION: A-74-065, October 1, 1974
ISSUE APPROPRIATE NOTICES TO ALERT AIR CARRIERS TO INFORM FLIGHTCREWS WHO MAY BE INVOLVED IN CARRIAGE OF CERTAIN DANGEROUS ARTICLES CAPABLE OF PRODUCING SELF-SUSTAINING CHEMICAL REACTIONS THAT RELIABLE IN-FLIGHT THREAT ASSESSMENT OF PROBLEMS ASSOCIATED WITH SUCH ARTICLES OFTEN WILL BE EXTREMELY DIFFICULT, IF NOT IMPOSSIBLE.

SOURCE OF RECOMMENDATION: PAN AMERICAN WORLD AIRWAYS, INC.,
707 SERIES,
BOSTON, MASSACHUSETTS,
November 3, 1973

STATUS: CLOSED - RECONSIDERED

RECOMMENDATION: A-74-066, October 1, 1974
ADVISE AIR CARRIERS TO INFORM FLIGHTCREWS THAT SMOKE OR FIRE CAUSED BY OXIDIZING AGENTS AND CERTAIN OTHER CHEMICALS CANNOT BE CONTROLLEDBY EXISTING EMERGENCY PROCEDURES, AND THAT ANY ABNORMAL IN-FLIGHT OCCURENCE WHICH COULD BE LINKED TO DANGEROUS ARTICLES SHOULD BE CONSIDERED AN UNSAFE CONDITION AS PRESCRIBED BY 14 CFR 121.557 AND .559, REQUIRING AN IMMEDIATE DECISION AND ACTION TO "LAND THE AIRPLANE AT THE NEAREST SUITABLE AIRPORT, IN POINT OF TIME, AT WHICHA SAFE LANDING CAN BE MADE."

SOURCE OF RECOMMENDATION: PAN AMERICAN WORLD AIRWAYS, INC.,
707 SERIES,
BOSTON, MASSACHUSETTS,
November 3, 1973

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: FIRE

RECOMMENDATION: A-74-098, December 5, 1974
REQUIRE THAT AUTOMATIC-DISCHARGE FIRE EXTINGUISHERS BE INSTALLED IN LAVATORY WASTE PAPER CONTAINERS ON ALL TRANSPORT AIRCRAFT.

SOURCE OF RECOMMENDATION: 747 SERIES,

SOURCE OF RECOMMENDATION: 727 SERIES,
December 5, 1974

STATUS: CLOSED - UNACCEPTABLE ACTION

RECOMMENDATION: A-79-016, May 1, 1979
THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: FUND AND GIVE HIGHEST PRIORITY TO AN EVACUATION SLIDE FABRIC TEST PROJECT WITH A VIEW TOWARD DEVELOPING AND CERTIFICATING FIRE-RESISTANT MATERIALS FOR THESE DEVICES.

SOURCE OF RECOMMENDATION: CONTINENTAL AIRLINES, INC.,
DC-10 SERIES,
LOS ANGELES, CALIFORNIA,
March 1, 1978

STATUS: OPEN - ACCEPTABLE ACTION

TOPIC: FIRE

RECOMMENDATION: A-81-012, February 10, 1981
THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: REEVALUATE THE "CLASS-D" CERTIFICATION OF THE L-1011 C-3 CARGO COMPARTMENT WITH A VIEW TOWARD EITHER CHANGING THE CLASSIFICATION TO "C," REQUIRING DETECTION AND EXTINGUISHING EQUIPMENT, OR CHANGING THE COMPARTMENT LINER MATERIAL TO INSURE CONTAINMENT OF A FIRE OF THE TYPES LIKELY IN THE COMPARTMENT WHILE IN-FLIGHT.

SOURCE OF RECOMMENDATION: L1011 SERIES,
RIYADH, SAUDI ARABIA, SAUDI ARABIA,
August 19, 1980

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-81-013, February 10, 1981
THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: REVIEW THE CERTIFICATION OF ALL BAGGAGE/CARGO COMPARTMENTS (OVER 500 CU. FT.) IN THE "D" CLASSIFICATION TO INSURE THAT THE INTENT OF 14 CFR 25.857(D) IS MET.

SOURCE OF RECOMMENDATION: L1011 SERIES,
RIYADH, SAUDI ARABIA, SAUDI ARABIA,
August 19, 1980

STATUS: OPEN - ACCEPTABLE ACTION

TOPIC: FIRE

RECOMMENDATION: A-83-046, July 1, 1983
THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: ISSUE A TELERT MAINTENANCE BULLETIN TO ALL PRINCIPAL AIRWORTHINESS INSPECTORS TO INSPECT IMMEDIATELY ALL LAVATORY PAPER AND LINEN WASTE RECEPTACLE ENCLOSURE ACCESS DOORS AND DISPOSAL DOORS ON THE APPLICABLE AIRCRAFT FOR PROPER OPERATION, FIT, SEALING, AND LATCHING FOR THE CONTAINMENT OF POSSIBLE TRASH FIRES, IN ACCORDANCE WITH THE REQUIREMENTS OF AD 74-08-09.

SOURCE OF RECOMMENDATION: EASTERN AIRLINES, INC.,
DC-9 SERIES,
TAMPA, FLORIDA,
June 25, 1983

STATUS: OPEN - INITIAL RESPONSE RECEIVED

RECOMMENDATION: A-83-047, July 19, 1983
THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: ISSUE AN AIRWORTHINESS DIRECTIVE (1) TO REQUIRE AN IMMEDIATE INSPECTION OF THE LAVATORY FLUSHING PUMP MOTOR AND THE ASSOCIATED WIRING HARNESSES BETWEEN THE TIMING COMPONENTS AND THE MOTOR IN THE LAVATORIES OF TRANSPORT CATEGORY AIRPLANES FOR EVIDENCE OF MOISTURE-INDUCED CORROSION OR DETERIORATED INSULATION AND TO REQUIRE THAT FLUSHING PUMP MOTORS OR WIRING HARNESSES WHICH EXHIBIT SUCH CONDITIONS BE RELPLACED, AND (2) TO ESTABLISH APPROPRIATE PERIODIC INTERVALS FOR REPETITION OF THESE INSPECTIONS.

SOURCE OF RECOMMENDATION: AIR CANADA,
DC-9 SERIES,
CINCINNATI, OHIO,
June 2, 1983

STATUS: OPEN - AWAIT REPLY

TOPIC: FIRE

RECOMMENDATION: A-83-048, July 19, 1983
THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: ESTABLISH, IN CONJUNCTION WITH THE FLUSH PUMP MOTOR, TIMER, AND AIRFRANE MANUFACTURERS, A PROCEDURE WHICH AIRLINE MAINTENANCE PERSONNEL COULD EMPLOY TO VERIFY THAT THE ELECTRICAL CIRCUITRY OF LAVATORY FLUSHING PUMP MOTORS HAS BEEN DAMAGED BY CORROSION OR OTHER CAUSES SO AS TO PRODUCE EXCESSIVE HEAT DURING MOTOR OPERATION.

SOURCE OF RECOMMENDATION: AIR CANADA,
DC-9 SERIES,
CINCINNATI, OHIO,
June 2, 1983

STATUS: OPEN - AWAIT REPLY

RECOMMENDATION: A-83-049, July 19, 1983
THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: ISSUE A MAINTENANCE ALERT BULLETIN TO REQUIRE PRINCIPAL MAINTENANCE INSPECTORS TO ASSURE THAT AIRLINES HAVE AN ACCEPTABLE PROGRAM (1) FOR THE FREQUENT REMOVAL OF WASTE FROM ALL AREAS OF THE LAVATORY WITH PARTICULAR ATTENTION TO THOSE ENCLOSED AREAS IN AND AROUND THE WASTE RECEPTACLES, AND (2) WHICH GIVES SUFFICIENMPHASIS TO AREAS SUSCEPTIBLE TO THE ACCUMULATION OF FLUIDS IN THE VICINITY OF WIRE HARNESSES AND OTHER ELECTRICAL COMPONENTS WHICH CAN CAUSE CORROSION.

SOURCE OF RECOMMENDATION: AIR CANADA,
DC-9 SERIES,
CINCINNATI, OHIO,
June 2, 1983

STATUS: OPEN - AWAIT REPLY

Mr. BURNETT. I might say that in my opinion the Safety Board has been too liberal with the FAA in rating their responses acceptable on many of our open recommendations. In fact, approximately 10 days before I became a member of the Safety Board, we sent a letter to the FAA rating their responses to the smoke detectors and other issues arising out of the Varig fire as acceptable, even though they had backed away from commitments they had made to us.

The only way I can explain that is when you are going up against a bear with a popgun you hate to use your only cork. Our only cork is that declaration that the action is unacceptable. I think sometimes we have been too conservative in using it. I have the information here that we have 44 fire-related recommendations since 1959. I don't know at this point how many of those——

Mr. LEVITAS. You don't know how many are open or how many are implemented or rejected?

Mr. BURNETT. We will include them with the information previously requested.

Mr. LEVITAS. Without objection it will appear in the record at that point.

Mr. LEVITAS. I appreciate your last comment, I have been very critical of the Safety Board, as a matter of fact, for not being as persistent, as diligent or as strict in following through on these recommendations. It is also my—and you can confirm this, if it is correct or incorrect—that in a number of instances the recommendations the Safety Board has made and some which were still open or were not implemented are what I have called second time around recommendations. "I told you recommendations." That the recommendation was made with respect to a particular accident, and that at a later time another accident occurred and the same recommendation was made because it hadn't been implemented to begin with. Is that correct?

Mr. BURNETT. Yes; there have been instances of that. And when we issue the Cincinnati report there may be some more of them.

Mr. LEVITAS. Several news accounts following the Air Canada accident contain confusing information with regard to the real purpose as to the use which might be made of the passenger oxygen masks. The confusion revolves around whether or not the masks could have been deployed so that the passengers might use masks for breathing to escape from the smoke and toxic fumes, or whether such deployment would have contributed to the already discovered lavatory fire.

It is my understanding use of these masks would not have helped since the use of masks also allows some of the ambient air in the cabin to filter through.

Mr. BURNETT. That is correct, Mr. Chairman. The cabin oxygen system as opposed to the cockpit oxygen system is what is called diluter demand, which means it is controlled barometrically and when you are below 10,000 feet you get basically the ambient air that is available in the cabin. So the use of the oxygen mask and oxygen system below 10,000 feet would not have benefited the passengers in this case.

We are going to have to look at that design feature as part of the current investigation to see whether or not the concerns are valid. One thing we must answer is why it was designed that way. I am not sure it was altogether because of fire safety considerations. And then we are going to have to resolve the issue as to whether that is really a wisely designed feature.

There are pros and cons to that issue.

Mr. LEVITAS. I might say that on Thursday of this week, and in subsequent hearings, we will be receiving testimony on technology that has already been developed in the matter of emergency passenger breathing apparatus which we have heard about. Mr. Oberstar made reference to one such item earlier. But it was interesting to me in that segment that you showed us of the video tape that of the passengers who survived, all of them used the rather advanced technology of holding a damp cloth over their face, and that enabled them to filter out some of the smoke and toxic fumes.

Do you know whether or not that technique of distributing damp towels or other materials to cover people's face is part of the training program and is a requirement in the training program of flight attendants, or was it just ingenuity of the flight attendants in this particular occasion?

Mr. BURNETT. No, we do not at this time, Mr. Chairman. But, of course, we will be asking that question in the course of the investigation. I might point out that we do not know whether those people who did not survive this accident also used the same technique. We know that there were not enough towels to go around. But, of course, some of the people who survived did not have towels, wet towels, and we—I am afraid that the remains will not be sufficient for us to be able to determine that issue. So we don't know whether that really made the difference.

It is an interesting observation, that all those who survived were protecting their faces. At least it reflects a need on the part of the people there for some sort of nasal protection or breathing filter. But we don't know at this time what conclusions we can make from it.

Mr. LEVITAS. Well, if the flight attendant who distributed those damp towels might be able to shed some light on the approximate number of the towels that were distributed, it might give you some indication of whether or not a great many of the people who did not survive had access to those towels.

Mr. BURNETT. There were 20 towels distributed.

Mr. LEVITAS. And how many passengers survived?

Mr. BURNETT. Twenty-three survived.

Mr. LEVITAS. Two of the others you identified used other devices; I think you said a vest.

Mr. BURNETT. A vest in one case.

Mr. LEVITAS. That would indicate that all the towels were put to good use in terms of surviving. If all that got out actually used a towel and there were some 20 distributed, that would certainly indicate that the towels which were distributed were, in fact, used by people who survived the accident.

Mr. BURNETT. We are not at that point in our analysis yet. But it is certainly one of the issues we are looking at, Mr. Chairman.

Mr. LEVITAS. You also mentioned in your statement about the thick smoke in the cockpit which presented difficulty for the flight crew in observing their instrument panel. And news accounts contained reports that the flight crew emergency breathing equipment did not work very efficiently, with the result that they had to remove their goggles or glasses and mask.

Is that a correct report? And what information do you have about that?

Mr. BURNETT. Would you take that?

Mr. KAPUSTIN. Mr. Chairman, the breathing equipment itself functioned. However, the smoke goggles fogged. The type of goggle that was used was a nonvented.

I don't recall the exact recommendations. There have been recommendations made in that area also. That was a real problem. They had to take the goggles off to clean them out so they could see.

Mr. LEVITAS. It is my understanding the purpose of those goggles is to permit the flight crew to be able to function where there is smoke in the flight deck. And your testimony is that they had to take the goggles off because they had to wipe them clean in order to be able to see out of them?

Mr. KAPUSTIN. Yes, sir. They fog up. The only type of goggle that apparently works is a vented type of goggle, or one that has pressurized oxygen forced into it, or some other type of venting system.

Mr. LEVITAS. Does FAA certify emergency breathing equipment which is contained on aircraft in the same way they certify the aircraft?

Mr. KAPUSTIN. Yes, sir.

Mr. LEVITAS. Where is the testing conducted, and are the test reports for equipment utilized in the Air Canada DC-9 being reviewed by NTSB?

Mr. BURNETT. Mr. McCormick?

Mr. MCCORMICK. With regard to the smoke goggle issue, if I might address that.

Mr. LEVITAS. Yes.

Mr. MCCORMICK. In 1973, following an accident in Boston which killed three crew members in in-flight fire, we recommended the smoke goggle issue be reexamined by FAA. Extensive work was done at CAMI in Oklahoma City, the FAA research facility. A report was issued in which the bottom line was that there were few, if any, smoke goggles being used in 1974-75 that met the intent of the regulations. The fit around the face was inadequate.

As Mr. Kapustin pointed out, in the Cincinnati accident they did fog up. They were not vented. They were uncomfortable to wear. In short, they were not effective.

The FAA was to have issued a technical standard order as well as an advisory circular. As late as 1981 we heard from the FAA that a TSO was still being discussed and developed. Two days ago we also checked with the FAA and learned from their staff engineers that a TSO will be forthcoming soon.

Mr. LEVITAS. You first made recommendations on this back in 1973, did you say?

Mr. MCCORMICK. Yes, sir. The date of the accident was 1973.

Mr. BURNETT. It was February 6, 1974, Mr. Chairman, that we made our recommendation, which was to require one-time inspection of all smoke goggles provided flight crews to ensure they met the appropriate Federal air regulations. The FAA did that. But we have been aware since that the goggles were not what they should be. I think the pilots have been aware of it. Everyone has been. No correction has ever been made.

Mr. LEVITAS. Where is the testing of these goggles and these masks conducted?

Mr. MCCORMICK. The only test that I am personally aware of is the test conducted by the FAA Civil Aeromedical Institute in Oklahoma City.

Mr. LEVITAS. Is NTSB in the process of reviewing the test data of the type of goggles and equipment utilized in the Air Canada DC-9?

Mr. BURNETT. We will be in the course of this investigation.

Mr. LEVITAS. In the past, investigations have discovered the problems you have described with the emergency breathing equipment. Is it your testimony that nothing has been done to correct those problems?

Mr. BURNETT. At least not enough has been done to correct them. I am not sure that I am ready to say right now that nothing has been done. But it certainly has not been sufficient, as we have seen with this accident.

Mr. LEVITAS. Along that same line, and part of the same old story, are you aware of recent tests conducted in the emergency breathing equipment which is presently being utilized on the 767 aircraft for the flight crew?

Mr. KAPUSTIN. Mr. Chairman, we have had reports of that. I have personally started to look into it, about 2 weeks ago. We have not had any firm information on it.

Mr. LEVITAS. Let me tell you what we have learned, and see if this squares with what you have learned. We have learned that testing was performed on this equipment on the 767, which is the latest generation of aircraft, bear in mind, and which has been certified by FAA. We have also learned that leaks were discovered in that equipment.

Are you aware of that?

Mr. KAPUSTIN. I was not aware of the specifics, Mr. Chairman. I was told that there have been problems during the certification and testing of the equipment. I have personally contacted two carriers that use them, and tried to determine if they have had any problems themselves. And the answer to that was no. But I do not have the information on the testing yet.

Mr. LEVITAS. Well, you wouldn't have a problem until you have had the fire with the smoke in the cockpit, obviously.

Mr. KAPUSTIN. Yes, sir.

Mr. LEVITAS. Did either of these carriers that you contacted indicate to you, or do you have any other information as to whether or not FAA has taken any action to notify and alert the operators of the aircraft of the fact of defective emergency breathing equipment for flight crews?

Mr. KAPUSTIN. No, sir, no information at all to that effect.

Mr. LEVITAS. I presume you will make inquiry about that as part of your investigation?

Mr. KAPUSTIN. Yes, sir.

Mr. LEVITAS. Well, we expect to get into that particular question in a great deal more detail on Thursday of this week when the airline pilots are testifying before the subcommittee.

I have some other questions——

Mr. **Burnett**. Mr. Chairman?

Mr. **Levitas**. Yes, Mr. Burnett.

Mr. **Burnett**. I am glad the committee recognizes the importance of this issue. None of these passengers would have survived had it not been possible to land the plane safely. So regardless of the kind of fire protection you have, to help the passengers survive, if you cannot land the plane, if the crew becomes ineffective or incapacitated, then you are going to lose the aircraft and probably all souls on board.

So I think this has been I would say a neglected issue both by the FAA and NTSB and one which it is certainly important for us to address.

Mr. **Levitas**. I am glad you made that observation, Mr. Burnett. First I want to say, and this is my conclusion based on everything I have read and heard, that the performance of the flight crew and the performance of the air controllers who were involved in this matter were outstanding and exemplary and courageous. And had it not been for that professional performance and their courage that the disaster and the tragedy would have even been worse. One of the things that we will be getting into in the course of these hearings very specifically is the protection that is afforded to flight crews, including the cabin attendants, in order to enable them to carry out their important safety responsibilities in emergencies of this type, including providing appropriate training and appropriate breathing equipment.

Mr. **Burnett**. That brings us to another recommendation we have made, Mr. Chairman. We have recommended that the FAA require a full face mask for flight attendants to use in the event that they need to fight a cabin fire. At one time the FAA indicated to us that they were going to do that; in 1981 they reversed themselves. We certainly believe that the circumstances of this accident indicate there was a fire extinguisher discharged blindly into the lavatory because the flight attendant was not able to enter due to the dense smoke. They did have some portable oxygen on board, but it was there for medical purposes. And without a full face mask to provide some protection from the irritants that would be in the lavatory, no one was able to enter it. And it was probably quite wise that they did not.

Mr. **Levitas**. Let me make sure I understand. FAA previously recommended at some point, and you might furnish me the date, that flight attendants be provided with emergency breathing equipment, a face mask of some sort, specifically for the purpose of helping them extinguish a fire under conditions where the smoke would otherwise inhibit their ability to do so. Is that correct? When was that recommendation given?

Mr. **Burnett**. September 5, 1973. It followed the Varig accident in France. The recommendation was to require emergency oxygen bottles and full face smoke mask for cabin attendants to permit them to fight lavatory fires.

Now, at one time, on May 2, 1974, we got this response from the FAA: "The FAA agrees that full face mask protection should be available to cabin attendants but not on wide-bodied planes since the crew is so large." We basically felt that was acceptable, and believed that each flight attendant should have access to such a mask but not that each attendant should have one. On March 14, 1979, there was some rulemaking activity.

On August 19, 1981, the rulemaking project on protective clothing was terminated. The FAA said it would not materially contribute to maintaining a safe aviation system. The FAA then went on to say they were developing a new TSO.

Mr. LEVITAS. Now, in that connection, after 1981, when that rulemaking was withdrawn, we have the Air Canada accident, a fire in the lavatory. And the cabin attendant in that instance took a fire extinguisher and tried to extinguish the fire, presumably in that lavatory, but had to do it, I think your word was in a random fashion——

Mr. BURNETT. Blindly.

Mr. LEVITAS. Blindly, because they didn't have a protective mask which would have let them do it, as the recommendation originally had contemplated.

Mr. BURNETT. As the committee knows, a fire extinguisher should be directed at the base of the flame, the burning material. We are not sure at all whether it would have been possible to do so in this case. The point was there was a need to do so if it could have been done so. And it was impossible to enter the lavatory. This reinforces our concern we had when we made that recommendation.

Mr. LEVITAS. As I said earlier, it is another of these "I told you so" situations developing, it seems to me.

Mr. BURNETT. Perhaps. I think in the course of this we are going to have to look at some sort of, system that can be activated from the outside of the lavatory without entering at all. That is one of the options we are going to have to look at. With all these options there are some problems.

Mr. LEVITAS. Thank you.

Mr. Molinari?

Mr. MOLINARI. Mr. Burnett, did I understand you correctly to say that the attendant when she first opened the door of the lavatory saw a light, gray smoke?

Mr. KAPUSTIN. That is correct, sir.

Mr. MOLINARI. Then subsequently you indicated that the copilot came out to help, couldn't open the door because there was dense smoke. Heat, but also you mentioned dense smoke. Do I interpret that as, that the fire had spread so rapidly as to create so much more smoke, dark smoke, in a short period of time? There seems to be a contradiction in what you are saying.

Mr. BURNETT. When you are dealing with fire, Congressman, of course, 1 minute can be a very crucial period of time. That is one of the reasons we are so concerned with the need to have smoke detectors.

Mr. MOLINARI. I understand. What is your testimony as to what happened here. Why was he not able to gain access shortly after she did?

Mr. BURNETT. He went there first, I think, opened it, there was black smoke. Then the second time he felt the door and it felt so hot that he was reluctant, probably wisely so, to open it. So he did not open it the second time he checked.

Mr. MOLINARI. Let me ask you this. When we saw that film, I believe it indicated that the plane had been on the ground 9 minutes when we first started to see the filming segment. Is that correct?

Mr. BURNETT. Yes, that is correct.

Mr. MOLINARI. It had been on the ground 9 minutes. What we observed, was that continuous, or were there gaps, so that although it was a 10-minute segment or thereabouts, it might have been spread out over 20 minutes. Do you know whether that was a continuous segment timewise?

Mr. BURNETT. I am not sure that I can tell you that. I can answer that for the record.

[The information received from Mr. Burnett follows:]

The film is an edited version of a 20-minute film.

Mr. MOLINARI. I will change the question and maybe direct you where I am going. We had a plane that had a problem; it landed. We see the plane on television 9 minutes after it was on the ground. The fact is that the ground was alerted to the fact that there was a problem with the plane, the firefighting equipment was on a standby basis.

The plane landed somewhat miraculously. Then we watch this film segment and we saw a fire engine standing by, spraying some substance, some liquid, foam, whatever, and watched the flames progress to consume the entire plane.

I am just wondering whether there was a failure of equipment here? Not enough equipment? Do we not have the potential to be able to extinguish that fire in a better manner than occurred here?

Mr. BURNETT. That is one of the issues that we are looking at in the course of our investigation. I don't think we can give you any conclusions at this point, but it is certainly one of the relevant issues and one we will address.

Mr. MOLINARI. Is this normal from your background? What you say to me is kind of shocking. I couldn't believe we had to watch a plane being consumed after they were alerted, after it was on the ground 9 minutes and we watched it progressively burn to the point where there was nothing but a shell left.

Is that normal? I am not asking you to make a judgment on what your examination is going to show, but is that normally what would happen?

Mr. KAPUSTIN. Congressman, what happened is that the foam ran out. They ran out of foam in a very short period of time. The requirement, I am just going by memory, I do not have the regulation here. The requirement for an airport of this size is 5,000 gallons of foam.

Mr. MOLINARI. For the entire airport?

Mr. KAPUSTIN. Yes, sir. The firefighting units have to have 5,000. This airport had 7,500 gallons. The international requirements I believe are 10,000 gallons. None of that is really enough to extinguish, to fight a fire of this magnitude. So they ran out. Additional foam came in from outside units from surrounding communities because of the mutual assistance pact. The other units eventually showed up. That is one of the main reasons you see large gaps in the firefighting activity, when they ran out of foam.

Mr. BURNETT. The FAA, Congressman, has been discussing reducing the crash fire rescue requirements at many of the airports in our country. This has been a matter of great concern to the Safety Board. This accident may give us some insight on the wisdom of those proposals.

Mr. MOLINARI. What is the recommendation of the Board with respect to adequate foam to handle an aircraft on fire?

Mr. BURNETT. I don't think we have made recommendations on that issue. It may be necessary to do so out of this accident.

Mr. MOLINARI. We certainly hope so. Let me ask you another question. You mentioned that you think that the Board has been too liberal in some of its recommendations. I would like you to expand on that.

Mr. BURNETT. What I said was I think the Board has been too liberal with the FAA in rating some of their responses to our recommendations as being acceptable action. To give you an example, we rated its response to a couple of our recommendations on cabin fire safety with respect to protective masks for cabin attendants and the smoke detectors for lavatories as being acceptable action as late as 1981, after having discussed this issue with them from 1973 to 1981, and after they, in fact, backed away from some of the earlier commitments they made to us.

I think that was unfortunate. The only redress we have is to say it is unacceptable action. And we have been reluctant to use that as long as we believed there was any chance left for progress on the matter. But in my opinion, in that situation and in many others we have been too liberal in rating FAA responses as acceptable.

Mr. MOLINARI. How long have you been with the Board?

Mr. BURNETT. I became a member of the Board on December 28, 1981, and was confirmed as chairman, I believe, on March the 30th of 1982.

Mr. MOLINARI. You do have the right to conduct a hearing, though, do you not, a formal hearing into an accident such as occurred here?

Mr. BURNETT. Yes, and we are going to on this accident.

Mr. MOLINARI. You do have plans to have a hearing?

Mr. BURNETT. Yes, we do.

Mr. MOLINARI. Will FAA testify at that hearing?

Mr. BURNETT. I am sure there will be several people who are on the staff of the FAA who will be testifying. The Federal Aviation Administration is a party to the investigation, and they will be at the hearing and will be examining witnesses along with us.

Mr. MOLINARI. Can you tell me how the smoke got into the cockpit area? Do you know that at this point in time?

Mr. KAPUSTIN. The smoke got into the cockpit area initially through what is called a kick panel. It is a plate on the bottom of the cockpit door. That was missing. And the air flow is toward the front of the airplane.

What aggravated it further during the flight and during the emergency descent, is that in order for the captain to be able to see the few instruments that he had left, he had to crack the windows open momentarily to evacuate the smoke to give him a chance to get a glimpse of his instruments, and in doing that drew more smoke into the forward area.

I should probably touch on the fact that the smoke evacuation procedures published in the manufacturer's operating manuals are not designed to evacuate smoke from a continuing source such as we had here. The smoke evacuation procedures are simply designed to evacuate smoke from a fire or a source that has been eliminated and then clear the airplane. There is really no good procedure in effect or available to get smoke out of an airplane that is continuously generated.

Mr. MOLINARI. My concern is that which was expressed before. But for the fact that the pilot was able to bring this plane down, the probability is that everybody onboard would have died. The question I have is, is it the design of the aircraft that when there is smoke in the back of the cockpit, that area, that the smoke should not be permitted to enter the cockpit area so we can at least let the pilot get the plane down?

Mr. KAPUSTIN. I think the basic design and basic air flow patterns are such that it would keep it out of the cockpit up to a point. In a situation such as this one, obviously it was insufficient.

Mr. MOLINARI. Is that primarily because of that panel that was missing that you referred to before?

Mr. KAPUSTIN. No, sir. Even without the panel the door to the cockpit is not airtight. So with a high volume of smoke being directly behind it, there would have been good possibility of some smoke getting into the cockpit.

Mr. MOLINARI. I have one more question, then I think I would defer to the other members of the panel. On the question of the causes of death, who makes the determination now that the victims in this case would have died of toxic gases that accumulated there, or perhaps they burned to death? Who will be making that determination?

Mr. KAPUSTIN. We received, of course, toxicity samples on all the victims and, of course, blood samples on most of the survivors, also. All of the work so far has been done by the Civil Aeromedical Institute in Oklahoma City, some of it by an independent laboratory in Willow Grove, PA. We also retained samples for testing by the Armed Forces Institute of Pathology.

Mr. MOLINARI. What was the determination from those samplings?

Mr. KAPUSTIN. All of the fatalities were caused by toxic fumes.

Mr. MOLINARI. Thank you, Mr. Chairman. I would like to pass on to the other members and come back later.

Mr. LEVITAS. Certainly, Mr. Molinari.

Dr. Rowland?

Mr. Wise?

Mr. WISE. Thank you. On page 9 of your prepared statement, you state that—I forget whether you mentioned this—that the safety board had recommended the FAA require fire extinguishers in lavatory receptacles. Today you go on to cite an example on the following page, why you don't think that is true.

That is ludicrous, isn't it, to think that a fire that is begun in a waste receptacle is going to contain itself?

Mr. BURNETT. Well, it happens a number of times. There are fires that do develop in waste receptacles, and they have been successful in containing some of them in that way.

In the incident we investigated on June 25, we discovered a design problem with that particular model of waste receptacle. We have to realize that even if these containers are designed correctly so that they will provide an airtight container, they may not remain that way.

I am also concerned about the fact that sometimes the receptacles are so overloaded with paper the door won't close. This defects the intent of the design.

It has been appropriate that the FAA has sought to provide containment of the fires.

We saw part of the effectiveness of this in the video, where unburned paper was found inside the lavatory receptacle. But certainly that is not going to be the sole line of defense.

We have recommended that the FAA provide automatic fire extinguisher systems for those receptacles. The DC-9 in Cincinnati did have that kind of system and it did discharge. The evidence now is that the fire did not originate with the trash bin. The Eastern DC-9 that landed in Tampa on June 25 did not have that sort of system.

The FAA has never made the systems mandatory. I think that is regrettable, if not ludicrous.

Mr. WISE. The DC-9 that landed in Tampa, did that have smoke detectors?

Mr. BURNETT. No.

Mr. WISE. That, of course, is part of your recommendation also, isn't it?

Mr. BURNETT. That is correct.

Mr. WISE. Thank you very much.

Mr. LEVITAS. Thank you.

Mr. Snyder.

Mr. SNYDER. Thank you, Mr. Chairman.

I know that the first smell of smoke was mentioned to a flight attendant by a passenger seated in row 21.

How many rows are there in this plane?

Mr. BURNETT. We raised that question this morning, Mr. Chairman. I don't think we can answer it for you right now. But I believe that was toward the back of the aircraft.

There was a passenger in the aircraft who was ill. The flight attendants were giving some attention to that passenger, and being near her seat, they did smell smoke.

Now, when the first report came to the cockpit, it was about 11½ minutes after the first circuit breaker popped. So we have some indications that whatever event was occurring then was 11½ minutes in duration.

Mr. SNYDER. That is not getting to the point I was trying to find out. Something makes me think there is about 25 or 26 rows in the plane. I may be wrong about that. Counsel says he thinks 26.

I was curious as to whether or not there were passengers closer to the lavoratory than row 21 and whether or not there is any evidence that the smoke came from the lavatory directly or through the circulatory system of the plane, the first smoke that was detected.

Mr. **Burnett**. We feel it came from the lavatory. As you know, the ventilation system in the lavoratory is designed to pull odd doors away from the occupants' part of the aircraft.

Mr. **Snyder** That assumes it is operating properly.

Mr. **Burnett**. That is correct. It doesn't always, as we sometimes observe.

The FAA has raised in opposition to our recommendation for smoke detectors that the best detection is the nose and that inside the cabin, even in the lavatories, smoke will soon be noticed by people who will smell it. Well, the design is to keep that from happening.

Mr. **Snyder**. In other words. your answer is if your nose is in the lavoratory, that is the best system?

Mr. **Burnett**. That is right, but you may not be——

Mr. **Snyder**. I understand that and I agree with you.

As you know, and for the record, the airport at Cincinnati has got east-west runways parallel, 9 and 27 right and left, north-south runway 18 and 36.

According to news reports, the airplane first reported trouble about 25 nautical miles southwest of the airport; is that correct?

Mr. **Kapustin**. Yes, sir.

Mr. **Snyder**. According to the news reports, a transcript of the recording between the approach control—and I assume he was handed to approach control from Indianapolis center after the announcement of the emergency—approach control indicated he was going to land him on 18; is that correct?

Mr. **Kapustin**. No, sir. I believe it was 36. It was 36.

He was going to land him on 36. Then he changed his mind because he observed him to be too high to be able to—too close in and too high to be able to land on 36. He gave him vectors for 27 and repositioned the emergency equipment.

Mr. **Snyder**. By taking him to 27 instead of 36, another 14, 15 miles, didn't it?

Mr. **Kapustin**. I don't know exactly how much distance he had to travel.

Mr. **Snyder**. Didn't he take him 7 miles east of the airport?

Mr. **Kapustin**. He had to bring him around, yes, sir, to the 27 approach. He apparently—he would have been too high.

Mr. **Snyder**. Thirty-six or nine would have been the closest one, wouldn't it?

Mr. **Kapustin**. I don't know what—36, he was set up for 36 originally.

Mr. **Snyder**. Which would have been from the south to the north.

Mr. **Kapustin**. Yes, sir.

Mr. **Snyder**. He was southwest.

What is the descent ability of this airplane?

Mr. **Kapustin**. The descent rate, it can come down——

Mr. **Snyder**. Max.

Mr. **Kapustin**. Indicators read 6,000 feet a minute. You can descend a lot higher than that but it can—to make a normal landing without breaking the airplane, the last part of the approach and descent has to be reasonably stabilized.

To come in over the end of the runway at 2,000, you know would not permit that. There is a good chance he would run off the end of the runway if he attempted something like that.

We think in what we see from the transcript and interviews with the controller——

Mr. BURNETT. I don't want us to get too far into analysis at this point.

Mr. SNYDER. I am not asking you to analyze it. I am asking for the facts.

What is the descent rate of the airplane?

Mr. KAPUSTIN. The maximum descent rate could be way in excess of 6,000 feet a minute.

Mr. SNYDER. How much time elapsed from the time of the declaring of the emergency to touchdown?

Mr. KAPUSTIN. From the time he started emergency descent, which was at 7:09, just a little bit short of 10 minutes. Landing was at 7:20.

Mr. SNYDER. Ten minutes he could have theoretically descended 60,000 feet.

Mr. KAPUSTIN. Yes, sir.

Mr. SNYDER. But the determination to change from 36 to 27 left was because of altitude?

Mr. KAPUSTIN. Yes, sir, too high and too close. That was the controller's statement.

Mr. SNYDER. Am I correct that just before beginning of the current fiscal year, a discretionary grant was made to this airport from firefighting equipment?

Mr. KAPUSTIN. I do not have that information with me, sir. I don't know that.

Mr. SNYDER. Would you determine whether or not that is accurate?

I am just going from memory. I have not checked it out, so I am not trying to lead you into something that I know that you don't. But this airport is in the congressional district I represent.

It seems to me that they got a discretionary grant for firefighting equipment. If you determine that that memory is correct, then would you also determine whether or not, what it was for and whether or not it had been acquired?

Mr. BURNETT. Yes, we will.

Mr. SNYDER. A good deal has been said today, and I agree with it, about the reluctance of FAA to implement the recommendations of the NTSB over at least the recent years.

Do you have any opinion as to whether or not that reluctance has been based upon any pressure from industry, or industry opposition to these changes, or whether industry has gotten involved in even opposing them at all?

Mr. BURNETT. Well, I think there probably has been industry opposition to some of them.

I don't know whether I can analyze the motives of the FAA, although many times they have frankly told us that the reasons they have withdrawn from the course that they intended to follow was because of the cost that would be involved to the industry.

So that suggests that the industry was at least advocating a retreat from a position that had been laid out.

There has been, of course, industry involvement. For instance, the SAFER Committee, which made its report in June of 1980 and was the basis for the research program that has been ongoing since that time, involved industry representation.

Despite the fact that things could have happened prior to that and coincident with it, that was a good effort. It has produced some results—the SAFER Committee and the research that has been made since then.

We are certainly disappointed that many of the developments that have been identified through FAA research have not resulted in regulation.

I cite an example, aluminized slides were developed to keep from deflating from radiant heat during an evacuation. They gave a 2-year schedule but the slides don't have to be installed in all aircraft before the end of next year.

The Boeing 757's have aluminized slides; but the Boeing 767's don't. I think the FAA could have been more demanding of industry in its regulatory schedule, and should have required newly manufactured airplanes to have the new slides installed.

Mr. **Snyder**. You indicated that all you have got is a popgun with a cork in it. And that you don't have much recourse if FAA disapproves or does not implement recommendations made by NTSB.

Is there anything in your enabling legislation that prevents you from recommending legislation to the Congress?

Mr. **Burnett**. Well, that is an interesting question. I think the traditional interpretation has been that we do not make recommendations to the Congress. However, we are required to do a biannual review, which we are in fact submitting right now, which I think has been traditional for us to suggest some areas where congressional legislation might be forthcoming.

Mr. **Snyder**. If you are going to do that in this review, then apparently you legally can do that, I assume.

Mr. **Burnett**. Yes, I think we can, although there has been some dispute about that within the board.

Mr. **Snyder**. Well, I suppose you have got a legal counsel with your board.

Mr. **Burnett**. Yes, sir.

Mr. **Snyder**. General counsel?

Mr. **Burnett**. Yes, sir.

Mr. **Snyder**. Would you ask him to look into that?

Mr. **Burnett**. Certainly.

Mr. **Snyder**. If in fact, you can make recommendations to this committee, would you be inclined so to do?

Mr. **Burnett**. Well, yes, sir. In fact, we have many times in the form of testimony.

Mr. **Molinari**. Will the gentleman yield?

Mr. **Snyder**. Just one minute. I don't know that you have made recommendations for legislation in your testimony. Maybe you have.

Mr. **Burnett**. I think that is well taken.

Mr. **Snyder**. I have been on the Aviation Subcommittee since jursidiction came to this committee, I don't know, 8 or 10 years ago, until this year. And I know that you and your predecessors have testified concerning your recommendations to the FAA, which would be their promulgation of certain regulations.

Mr. **Burnett**. I think our testimony has been oversight oriented, rather than for legislation. However, we have commented on legislation as we did on Congressman Biaggi's legislation.

Mr. **Snyder**. I heard your remarks, I believe, generally endorsing that approach. But there was nothing in your remarks that indicated that that was all encompassing, and what your recommendations might be in regard to legislation.

Mr. **Burnett**. That is correct.

Mr. **Snyder**. I believe in light of FAA's action, or inaction, I should say, that if you had specific recommendations to make to the committee, the legislative committee that has jurisdiction, we would be inclined to take a hard look at perhaps attempting to enact some of that legislation.

I would urge you, if you have that ability under your enabling legislation, that you consider strongly doing that. And maybe we can, through that means, make FAA a little more inclined to act. If they think we are going to, there is a very good chance they might.

I want to yield to the gentleman.

Mr. **Burnett**. I appreciate that very much, Congressman.

Mr. **Snyder**. I notice the chairman of the subcommittee nodding in agreement, so I take it he is in agreement with that.

Mr. **Levitas**. Yes.

Mr. **Molinari**. I am looking at Public Law 93-633, which was titled the Independent Safety Board Act of 1974. Section 304, subdivision 3, I think is what you were referring to before.

It says, "Issue periodic reports to the Congress, Federal, State, and local agencies concerned with transportation safety and other interested persons recommending and advocating meaningful responses to reduce the likelihood of recurrence of transportation accidents," et cetera.

Why would that not include a recommendation to us to enact legislation?

Mr. **Burnett**. I don't know of any reason why not. I do know that prior to my being a member of the Board, I think there has been some discussion about whether or not it was appropriate for us to do that.

I don't want to suggest that I have reservations.

Mr. **Molinari**. I think it is very clear. I think meaningful response certainly would call for a recommendation of legislation where you felt it was incumbent upon us to do so.

I suggest that your counsel look at that section, and let us know, the subcommittee, whether it would permit you to do so or not. If not, we will clarify it.

Mr. **Burnett**. Certainly, where we have been invited to do so by a committee, I think it is quite likely we would do so.

Mr. **Snyder**. I have asked you to do it and the chairman has indicated his acquiescence, and since the FAA won't act, we would like to know what we can do——

Mr. LEVITAS. If the gentleman would yield, you can take it as official that this subcommittee requests that such recommendations be submitted to it.

Mr. BURNETT. Thank you, Mr. Chairman.

Mr. SNYDER. And I thank you, Mr. Chairman.

Mr. LEVITAS. Ms. Ferraro.

Ms. FERRARO. Thank you, Mr. Chairman.

I guess it was lucky for the 23 passengers who survived that the trip was going from Dallas-Fort Worth to Toronto and was able to land in Cincinnati. What would have happened if it was a trans-Atlantic flight where there was a fire in the bathroom?

Mr. BURNETT. Well, that would have been a much more serious situation, if in fact you could have one more serious than this. I think either the fire would have had to have been extinguished or there would have had to have been a ditching at sea.

Ms. FERRARO. I guess that gets to the point I hope I am going to make—with reference to the suggestion and recommendations by the Transportation Safety Board. Each of them gives a couple of minutes, whether it is the panes of glass that would add another 4 minutes' time to landing, the others allow for a few minutes here and there and every place else.

Why is there nothing done in a specific instance like this to contain the entire lavatory so that it would—the fire, if there were a fire in the lavatory, it would extinguish itself?

Mr. BURNETT. The first problem with that is that the lavatory is automatically ventilated.

Ms. FERRARO. Let me interrupt you for just a minute.

Why then is there no mechanism to cut off the air when there is a problem with the lavatory?

Mr. BURNETT. Well, that is something we certainly need to address in this. There is not, and that will be a potential recommendation that may come out——

Ms. FERRARO. It obviously can fuel the fire.

Mr. BURNETT. It is also important to understand that there was an air line was burned through. So even if there had been a cutoff, unless it was somewhere exterior to the lavatory, the progress of the fire itself made available an air source.

So certainly there was no opportunity to make an airtight lavatory. That is one of the alternatives we will have to look at.

Ms. FERRARO. What about the fuel line? In the film it also indicated the fuel line was very, very close to that lavatory.

Is there not a danger of that exploding?

Mr. BURNETT. Very much so, I would think.

Mr. Kapustin.

Mr. KAPUSTIN. Yes. The fuel line goes under the floor. The fire did progress to the area under the cabin floor.

The fuel line has to be there because the engine pylon is directly out board of there. The fuel line is shrouded and protected.

We are fully aware that if this fuel line had been compromised, they would have lost the airplane. There is no other place to locate the fuel line. It has to enter the engine compartment.

Ms. FERRARO. That is underneath the compartment, so that if you were able to do something to contain the fire in that compartment so it did not seep through, you would not have that problem with the fuel line then?

Mr. KAPUSTIN. That is correct.

Mr. BURNETT. There was very good protection on the fuel line, otherwise it would have burned through. In fact, it didn't in the whole course of the fire. It never did burn through.

Ms. FERRARO. It seems to me the recommendations you have made will do something. But they really won't solve the problem of someone inadvertently or deliberately starting a fire in the bathroom.

Mr. BURNETT. You have to remember that these recommendations came out of previous accidents. In the course of this accident we will perhaps make additional recommendations that are based on what we learn in the course of this investigation.

Ms. FERRARO. At the conclusion of your testimony, you talked about the four recommendations you made, yet you say that on new planes you would—let me find exactly what you say.

You say:

> Safety Board is convinced that fire resistant cabin windows, fire block material, seat cushions, improved emergency light, smoke detectors and fire extinguishers in cabins and smoke loading systems for crew members can be installed on all newly manufactured aircraft without undue delay. I would also encourage retrofitting where practicable.

Why do you limit it? Why would it not be practicable to put these things into planes——

Mr. BURNETT. The answer to that may differ, according to the feature we are discussing.

Clearly it will be practicable to retrofit seats with fire blocking material. I think it should be practicable to retrofit aluminized slides. Windows may be something different. Some of these things are automatically replaced. The cabin is refurbished periodically anyway.

Given that schedule, we should certainly expect they would be retrofitted. On others, there may be cost factors that would be prohibitive. That, I think, varies from point to point.

But I think it is important to note that the FAA, after having developed the aluminized slide, has failed to implement any regulation that would mandate retrofitting of slides.

These slides have a long life. In fact, unless the FAA decides to change strategy and use a different type of slide, the ones that are in aircraft now will be there for the life of the aircraft.

Ms. FERRARO. So in some planes, you would not be able to use the new material at all, and in others it would just be prohibitive cost.

Mr. BURNETT. It depends, I think, not upon the plane but upon the feature we are talking about. Clearly fire blocking material, as far as seats are concerned, should be retrofitted.

I think the FAA is quite right to let the airlines do that in the course of their retrofit schedule. But I want to point out that we are concerned about the schedule they are adopting.

I am not sure that I am correct about this. But it seems that the FAA is going to allow a couple of years for rulemaking, after already having had an industry committee formed at one time which recommended the course of development they followed. Then they are going to allow another couple of years to tool up for production of materials that the industry is not going to be surprised about it.

Then it is going to allow another 3 years for a schedule for refurbishing the aircraft, for installation, so it will be the end of the decade before all aircraft have the fire blocking seat covers.

Now, I hope that is not their intention, but I fear it is. All of those things are very relevant considerations. But I think the three grace periods that they are going to give there could be telescoped somewhat.

I would hope that this process would be completed within 5 years, or perhaps 4. I think maybe 3 is a little optimistic. But certainly 4 would be excellent. I think even 5 would be acceptable. But 7 is not.

Ms. FERRARO. If I can just followup on that. I can understand the schedule for mandatory refitting of all of the planes with each of the features we are discussing. But what about those planes? I assume that refitting is a routine thing that is done by airlines?

Mr. BURNETT. That is correct.

Ms. FERRARO. They look at their fleets and they refurbish them according to a schedule.

Are you then saying that with all these delays that the FAA is discussing, that those planes which are going to be refurbished next month or within the next 6 months will not be required to put in the new suggestions that are here?

Mr. BURNETT. Yes.

Ms. FERRARO. But would be able to retrofit without these and then waste 5 or 7 months, whatever the period is?

Mr. BURNETT. That is correct. In fact, newly manufactured aircraft today, for instance, do not have to have the aluminized slides even though two of the companies that produce the slides are already manufacturing them and are putting them in some aircraft. They are not required to be put in others rolling off the assembly line right now.

We are afraid the fire blocking seats are going to be treated in the same way.

Ms. FERRARO. So that maybe the Congress could do what we did with the noise standards, and require that retrofitting be done within a certain period of time?

Mr. LEVITAS. Would the gentlewoman yield?

Ms. FERRARO. I would be glad to yield.

Mr. LEVITAS. I am very interested in the line of questions and the answers that you are receiving because, again, it is an exact replay of what we heard in 1979.

I remember very well asking the Administrator of FAA at that time about state-of-the-art technology that would deal with many of these problems, and the great delays that were going to take place in the rulemaking retrofitting.

I said, what about the new generation of aircraft that we know will be coming in the next few years and indeed have since come? I said, will they be required to meet these higher standards or not?

And he said no. He says, "What we will do is require them to retrofit down the line."

But, as you have heard the Chairman of the National Transportation Safety Board say, that retrofitting process means perhaps as long as 7 to 10 years. What he didn't say I think we should say, and that is it may cost the loss of probably hundreds of lives. And that is what is very disturbing to me.

I appreciate the questions of the gentlewoman.

Ms. **FERRARO**. I want to followup with one last question. That is with reference to the improvements you are suggesting.

I got from your comments to me about the airflow and all the rest, that those are not the only recommendations that are going to come from your Board with reference to fire on planes.

Mr. **BURNETT**. Most of the recommendations we have been discussing we made 10 years ago and they have not been acted upon favorably by the FAA to this point.

Certainly I think out of this accident we will have additional recommendations based on the technology that is available today.

We have gotten some feeling the FAA has said after the French accident, "well, that was in France," and after the Saudi Arabian fire, "well, that was in Saudi Arabia." Now we hear them saying, "this is Air Canada, not an American line."

I don't know how close to home this has to get. It seems to me Kentucky is close enough.

For instance, I believe that airplanes manufactured in France are required to have smoke detectors. We understand that there have been some problems with those systems on U.S. operated Air-Bus A-300 aircraft, and the smoke detectors have been disconnected. But to some degree, the French are ahead of us, fortunately.

Ms. **FERRARO**. I thank the chairman.

Thank you.

Mr. **LEVITAS**. Thank you.

Mr. McEwen.

Mr. **MCEWEN**. Thank you, Mr. Chairman.

Mr. Burnett, I welcome you to the committee. As always, it is good to see you again.

You mentioned in your testimony the fire resistant polycarbonate windows were devised and developed in the early 1970's and still are not used on aircraft. Can you give us any explanation as to why they have not been incorporated in production?

Mr. **BURNETT**. Yes; there are still some problems with them as far as the quality of the lamination, which has to do with preserving the integrity of the window in a pressurized environment.

Mr. McCormick might be able to elaborate somewhat more.

Mr. **MCCORMICK**. Airplane windows must withstand the pressure changes associated with high altitudes. Additional research remains to be done on the ability of the laminations used in the polycarbonate windows to withstand without failure these pressurization cycles.

The other developmental problem that remains is the fit of the window itself and, how well a seal it will make.

Mr. **MCEWEN**. Thank you.

Mr. Chairman, in your testimony you made reference to the June 25 lavoratory fire onboard a DC-9, a flight from Atlanta to Tampa. From your investigation, was this caused by smoking in the lavoratory, do you believe, or what was the source of the fire to which you referred?

Mr. Burnett. There was a fire in the trash receptacle. I don't know that we have established yet that it was smoking in the lavatory, although that certainly is a matter of suspicion.

There are, of course, other ignition sources. There are electrical ignition sources there, as well as the combination of electrical wiring and water. So there are things other than smoking that make the lavatory a particularly apt spot to have a fire develop.

But that, of course, is one of the things——

Mr. McEwen. Did you conclude your investigation on that?

Mr. Burnett. No; we have not.

Mr. McEwen. So will you be attempting to draw a conclusion as to the source of the fire?

Mr. Burnett. Yes; we will.

Mr. McEwen. Thank you, Mr. Chairman.

Mr. Levitas. Thank you.

Dr. Rowland.

Mr. Rowland. It states the fire started in the left rear lavatory; is that correct?

Mr. Burnett. Yes.

Mr. Rowland. From the tape we saw it appears the fire was in the front part of the aircraft. That is where it broke into the open, is that correct?

Mr. Kapustin. The origin of the fire was in the left rear lavatory and was probably contained to that general area until the airplane got on the ground.

I am not a fire expert. Fire experts tell me that the airplane under such conditions will fill with very flammable gases. As soon as additional oxygen is admitted you get what they call a flashover. And, of course, the entire airplane, particularly the forward part, was engulfed in flames once external air was permitted to enter. There was no fire inflight in the forward area.

Mr. Rowland. That was my question. I am curious to know why the fire seemed to be, after the plane got on the ground, in the forward area, and yet it started in the rear of the aircraft.

Mr. Kapustin. We have had five of the country's top fire experts working with us and still working with us, and their explanation is simply one of a flashover phenomenon, which I don't fully understand myself.

Mr. Rowland. I don't understand that either.

In what part of the cabin were the passengers that survived seated?

Mr. Kapustin. They moved most of the passengers, in fact they moved all of the passengers eventually toward the front of the airplane.

There were some survivors scattered throughout the front. There were no people left in the back.

Mr. Burnett. I think the answer to that is I don't think we have been able to identify a pattern of survival versus nonsurvival. There is also, I think, a problem in that some of them had left their seats and their bodies were found in the aisles.

It is a problem to reconstruct where they were. I think we are still continuing in that effort.

Mr. Kapustin. That is right.

Mr. ROWLAND. I want to learn more about flashover. I would like to have more information on that as to how that works.

Mr. MCCORMICK. In this accident, the fire is believed to have started somewhere in the aft portion of the aircraft. The heating of the compartment materials, again, primarily the seat cushions, produced toxic substances, irritants, combustible gases, and smoke. As these combine, they rose to the top of the cabin.

This smoke then moved forward in the cabin. As Mr. Kapustin pointed out, as soon as the doors were open it is our belief right now, that oxygen was added to the sealed cabin.

The super-heated air and combustible gases gather along the ceiling along with the smoke and the gases ignite, very similar to spontaneous combustion. The fire flashes the length of the cabin along the ceiling.

We saw this in the Saudi L-1011 accident several years ago. Super-heated air gathered along the ceiling combusted, and traveled extremely fast, a matter of microseconds, the length of the cabin. In this process it is consuming oxygen as well.

Mr. BURNETT. Congressman, one of the things we will have to look at as a way of dealing with this is the possibility of venting off the super-heated air that collects at the top of the cabin. That may be something we may be able to do in the inflight situation.

Mr. ROWLAND. If a rear door had been open, with oxygen coming in from the back, outside air, is it likely the fire would have occurred in the rear of the cabin, based on what you said. Is that correct?

Mr. MCCORMICK. Not so much it would occur in the rear, but I think what you get there is a tremendous draft of air would result which would probably accelerate movement of these gases throughout the aircraft and accelerate the progress of the fire. This will be examined further during our investigation.

Mr. ROWLAND. Thank you.

Thank you, Mr. Chairman.

Mr. LEVITAS. Thank you, Dr. Rowland.

Mr. Burnett, you and I along with some others, other Government officials and aviation interest groups, recently received an anonymous letter with regard to the fire aboard the Air Canada DC-9. Can you advise me whether the Board is actively pursuing the information contained in that letter?

Mr. BURNETT. Mr. Kapustin.

Mr. KAPUSTIN. Yes, Mr. Chairman. We have turned the letters, the ones we have in our possession, and some of the envelopes the letters came in, over to the FBI. That was done Friday.

We should be hearing some—in fact, we will have some additional material from them today.

Mr. LEVITAS. Would you submit that to the subcommittee, please?

Mr. KAPUSTIN. The results?

Mr. LEVITAS. Yes.

Mr. KAPUSTIN. Yes, sir.

[The information received from Mr. Kapustin follows:]

FEDERAL BUREAU OF INVESTIGATION,
Louisville, KY, August 30, 1983.

RUDOLF KAPUSTIN,
Senior Air Safety Investigator, Hearing Officer, National Transportation Safety Board, Aviation Accident Division, Washington, DC.

DEAR MR. KAPUSTIN: This will confirm the conversation on August 12, 1983 between SA Vincent W. Behan of this office and yourself regarding an anonymous letter dated June 12, 1983 to Mr. Jim Burnett, Chairman, The National Transportation Safety Board, wherein it was alleged that an employee of the Mary Kay Cosmetics who was a survivor of the Air Canada DC9 accident June 2, 1983 at the Greater Cincinnati Airport, related to Mary Kay Ash, President, Mary Kay Cosmetics, a smoking incident, that according to the letter's author may have been a causal factor of the accident.

On August 8, 1983 agents of our Dallas, Texas Office of the FBI determined that the employee and survivor aforementioned is one Brenda Mayne, 296 Scott Street, Midland, Ontario, Canada.

A search of the Air Canada manifest for Flight 797 of June 2, 1983 determined that Brenda Mayne was in fact listed thereon.

On August 10, 1983 Brenda Mayne was telephonically contacted by SA Behan at her place of business in Canada, telephone 705-526-8354, and found to be most cooperative. Ms. Mayne advised that the smoking incident she had related to Mary Kay Ash took place on a United Airlines Flight, June 4, 1983 from Chicago to Toronto and had absolutely nothing to do with the Air Canada accident June 2, 1983.

If I can be of any further assistance, please do not hesitate to call.

Very truly yours,

JAMES H. YELVINGTON,
Special Agent in Chicago.
(By) JAMES E HUGGINS, *Supervisor.*

Mr. LEVITAS. Now, Mr. Burnett, evacuation of an aircraft under emergency conditions is important, and very likely critical to the chances of survival. Does the staff of the Safety Board look into the training of flight crews for passenger evacuation following instances of accidents where reports of evacuation difficulties are discovered?

Mr. BURNETT. Yes; we do. We are looking at this in this accident.

We are also looking at related issues in the investigation of the near ditching of the Eastern L-1011 off the coast of Miami.

Mr. LEVITAS. Have your inquiries resulted in any recommendations to FAA about evacuation matters?

Mr. BURNETT. Well, I assigned one yesterday, as a matter of fact, to the FAA in which we are asking them to convene an industry-Government task force to look at improved ways to educate passengers.

We are not satisfied that passengers are being properly educated with the briefing cards that are available now. We think the video tape briefings have been an improvement.

We are very concerned. It has come up in connection with the Spanish Spantex accident, as well as the L-1011 situation that passengers do not know as much as they need to know to prepare them for an emergency.

I am interested in examining the options of hands-on training for frequent flyers to have a cadre of people who have had the experience of deploying the slides and going down the slides and who can provide leadership.

In the L-1011 situation, the flight attendants had a hard time finding people who were willing to assist. I suspect it was because they didn't understand their instructions and were reluctant to undertake something unknown. So I think this more than flight attendant training.

Another related issue bothers me. The FAA has approved the use of Halon fire extinguishers in cabins. If you have seen demonstrations, you can see that they are a remarkable improvement.

Some major carrier flight attendants never receive hands-on instructions for actually putting out a fire. Others do.

But it is a matter of concern that if the flight attendants have not had the experience of using a fire extinguisher to put out a live fire, they are not going to be nearly as competent to fight an inflight fire.

There are many issues we need to look at in terms of training. Often we fault, or at least are interpreted as criticizing the flight crew or cabin crew for their conduct following an emergency on matters where if the crew had been properly trained, there would have been a more favorable response to the emergency.

Mr. LEVITAS. Well, I would like for you to submit to the subcommittee for the record the list of recommendations that you have made with respect to evacuation procedures and training.

Mr. BURNETT. Certainly.

[The information received from Mr. Burnett follows:]

AVIATION SAFETY RECOMMENDATIONS ON THE TOPIC OF EMERGENCY EVACUATION AND PASSENGER BRIEFINGS

RECOMMENDATION: 5-RE-45, FEBRUARY 18, 1965,
REFORM GOVERNMENT-INDUSTRY TASK GROUP TO REASSESS SAFETY PROVISIONS AS A RESULT OF LESSONS LEARNED FROM ROME CRASH FIRE AND EVACUATION, NAMELY

- o REDUCED EVACUATION TIME
- o MARGINAL EVACUATION CHUTE MATERIAL AND DEPLOYMENT METHOD
- o NO EMERGENCY ALARM SYSTEM
- o INADEQUATE PASSENGER EMERGENCY EVACUATION BRIEFING

SOURCE OF RECOMMENDATION: TRANS WORLD AIRLINES
B-707-331,
ROME, ITALY
NOVEMBER 23, 1964

STATUS: CLOSED

TOPIC: EVACUATION/BRIEFING

RECOMMENDATION: 6-RE-26, NOVEMBER 30, 1965

- o REQUIRE A PROCEDURE BE USED SO THAT THE EMERGENCY LIGHTS ARE TURNED "ON" DURING ALL TAKEOFF AND LANDING OPERATIONS OF B-707, -720, AND -727 AIRCRAFT, AS WELL AS ALL OTHER TURBINE POWERED AIRCRAFT WITH AUTOMATIC EMERGENCY LIGHTING SYSTEMS.
- o CONDUCT A STUDY OF ALL OTHER TYPE AIRCRAFT BE MADE TO ASCERTAIN THE OPERATING FEATURES OF THEIR EMERGENCY AND EXIT CIRCUITRY TO ASSURE THE EMERGENCY LIGHTING OPERATING DURING ANY EMERGENCY.

SOURCE OF RECOMMENDATION: UNITED AIR LINES
B-727
SALT LAKE CITY, UTAH
NOVEMBER 11, 1965

STATUS: CLOSED

RECOMMENDATION: A-63-033, November 8, 1962
THE NTSB RECOMMENDS TO THE FEDERAL AVIATION AGENCY: (1) LIFE RAFT STOWAGE: PASSENGERS WERE UNABLE TO USE THE LIFE RAFTS STOWED IN THE WINGS. THE ONLY RAFT USED BY THE SURVIVORS WAS THE ONE STOWED IN THE FUSELAGE. THE BOARD RECOMMENDS THAT THE FAA RECONSIDER THE METHOD OF LIFE RAFT STOWAGE WITH A VIEW TO REQUIRE THE STORING OF ALL LIFE RAFTS INSIDE THE FUSELAGE. (2) LIGHTS ON LIFE RAFTS AND JACKETS: THE ONLY LIGHT AVAILABLE OUTSIDE THE AIRCRAFT WAS A FLASHLIGHT CARRIED BY THE CAPTAIN. PASSENGERS HAD DIFFICULTY LOCATING THE RAFT OR ONE ANOTHER IN THE WATER. HAD THE RAFT BEEN LIT AND HAD THERE BEEN A LIGHT INSTALLED ON EACH LIFE JACKET, MORE PASSENGERS WOULD HAVE SURVIVED. THE BOARD THEREFORE, RECOMMENDS THAT AN APPROVED LIGHTING SYSTEM BE REQUIRED FOR LIFE RAFTS AND THAT ALL LIFE JACKETS BE EQUIPPED WITH A SELF-ACTUATING LIGHT. (3) ADEQUACY OF LIFE JACKETS TSO C13: PASSENGERS COMPLAINED THAT THE JACKETS RODE UP AND AROUND THEIR HEADS AND INTERFERED WITH SWIMMING. ALSO, THE SHORT LENGTH OF THE CO2 CARTRIDGE LANYARD PRECLUDED THE AUTOMATIC INFLATION OF THE JACKET. IN VIEW OF THESE COMPLAINTS, THE BOARD RECOMMENDS THAT THE APPLICABLE TSO (TSO C13) BE REVIEWED TO INSURE THAT AN ADEQUATE LEVEL OF SAFETY IS BEING PROVIDED BY THE DETAIL REQUIREMENTS. (4) ADEQUACY OF SEAT TIE-DOWNS: ALTHOUGH THE DECELERATION WAS NOT EXTREME, MANY PASSENGERS FAILED TO EXTRICATE THEMSELVES BECAUSE OF SEAT FAILURES IN THIS SURVIVABLE ACCIDENT. THE BOARD WAS CONVINCED FROM THIS AND OTHER ACCIDENTS THAT AN INCREASE IN THE MINIMUM LEVEL OF SAFETY WAS LONG OVERDUE AND IT IS RECOMMENDED THAT THE STUDIES RELATIVE TO CRASH LOAD FACTORS AND DYNAMIC SEAT TESTING CRITERIA WHICH WE UNDERSTAND ARE NOW UNDER WAY IN YOUR AGENCY BE EXPEDITED TOWARD THE END OF ACHIEVING IMPROVED SAFETY IN THIS AREA AT THE EARLIEST DATE. (5) EMERGENCY INFORMATION: MANY PASSENGERS WHO SURVIVED THIS ACCIDENT AND OTHERS SUCH AS THE UAL DC-8 ON 7/11/61, THE AMERICAN B-720 AT BOSTON ON 9/24/61, AND THE AMERICAN L-188 AT KNOXVILLE ON 8/6/63 DID NOT KNOW THE LOCATION OF THE NEAREST EXIT. THE BOARD FOUND THAT THE PRINTED INSTRUCTIONS IN THE SEAT BACK POCKETS WERE NOT ENOUGH AND RECOMMENDS THAT PASSENGERS BE BRIEFED PRIOR TO THE TAKEOFF ROLL ON THE LOCATION AND ACTUATION OF EMERGENCY EXITS AND THE PROCEDURE TO BE FOLLOWED IN THE EVENT OF AN ACCIDENT.

SOURCE OF RECOMMENDATION: FLYING TIGER LINE, INC.,
L-1049H SERIES,
NORTH ATLANTIC,
September 23, 1962

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-67-016, April 17, 1967
IT IS RECOMMENDED THAT ALL PASSENGERS BE MADE AWARE OF THE PROCEDURES REQUIRED TO MOVE THE SEATS OUT OF THE WAY OF THE WINDOW EXITS. FURTHER, IT IS RECOMMENDED THAT AIRLINES UTILIZING MOVABLE PARTITIONS BETWEEN PASSENGER COMPARTMENTS ASSURE THAT THE OVERHEAD SIGNS ARE PROPERLY PLACED TO DEPICT THE EXACT LOCATION OF THE WINDOWEXITS AND THAT THE FLIGHT ATTENDANTS BE REQUIRED TO INDICATE WHERE EACH EMERGENCY EXIT IS LOCATED DURING THE PRE-TAKEOFF BRIEFING.

SOURCE OF RECOMMENDATION: April 17, 1967

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-68-031, November 4, 1968
THE BOARD RECOMMENDED: (1) AIR CARRIERS BE REQUIRED TO HAVE THE RETAINER BAR FOR ALL DOOR-MOUNTED SLIDES PLACED IN POSITION FOR SLIDE DEPLOYMENT AT THE FLOOR-LEVEL EMERGENCY EXITS PRIOR TO THE AIRCRAFT'S DEPARTURE FROM THE RAMP FOR FLIGHT. (2) FAA INSPECTORS REVIEW ALL PRINTED CARDS USED BY THE AIR CARRIERS TO SUPPLEMENT THE ORAL BRIEFING TO ENSURE THAT THEY INCLUDE CLEAR INSTRUCTIONS SHOWINGTHE DIRECTION PASSENGERS SHOULD TAKE UPON LEAVING THE WING WHENEVER OVER-THE-WING EXITS ARE USED FOR EVACUATING THE AIRCRAFT. (3) ALL AIR CARRIERS RE-EMPHASIZE, THROUGH THEIR CREW TRAINING PROGRAMS, THE BASIC PHILOSOPHY OF EMERGENCY EVACUATION THAT ALL CABIN EXITS THAT ARE NOT JUMPED, BLOCKED BY FIRE, OR OTHERWISE RENDERED UNUSABLE(INCLUDING VENTRAL STAIRS) SHOULD BE USED TO THE EXTENT REASONABLY POSSIBLE.

SOURCE OF RECOMMENDATION: AMERICAN AIRLINES, INC.,
727 SERIES,
SPRINGFIELD, ILLINOIS,
September 23, 1968

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-70-011, February 13, 1970
THE ADMINISTRATOR REQUESTED THE SAFETY BOARD'S VIEWS ON THE MATTER OF PASSENGERS DRINKING ABOARD AIR CARRIER AIRCRAFT. THE BOARD'S RECORDS FAILED TO INDICATE ANY AIR CARRIER TRANSPORT ACCIDENT IN WHICH DRINKING BY A PASSENGER CONTRIBUTED TO ITS CAUSE. NEVERTHELESS, THE BOARD, IN ITS BELIEF THAT UNRESTRICTED DRINKING BYPASSENGERS COULD PROVE HAZARDOUS, PARTICULARLY DURING THE EVACUATIONOF AN AIRPLANE FOLLOWING AN EMERGENCY, AGREED WITH THE ADMINISTRATOR, THAT A SELF-IMPOSED INDUSTRY-WIDE RESTRICTION APPEARED TO BE THE BEST SOLUTION TO THE PROBLEM. IF HOWEVER, THE INDUSTRY AMONG THEMSELVES COULD NOT REACH A SATISFACTORY AGREEMENT, OR IF THEIR IMPLEMENTATION OF AN AGREED LIMIT PROVED UNSATISFACTORY,THEN THE ADMINISTRATOR APPLY A REGULATORY LIMIT.

SOURCE OF RECOMMENDATION: February 13, 1970

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-70-015, April 3, 1970
THE BOARD RECOMMENDED: 1. THAT THE FAA AMEND PART 121 OF THE FAR'S TO REQUIRE THAT ANY TIME "FASTEN SEAT BELTS" SIGNS ARE TURNED ON IN FLIGHT, THE CREW MAKE A VERBAL ANNOUNCEMENT OVER THE PUBLIC ADDRESS SYSTEM TO ADVISE THE PASSENRS OF THE FACT, AND 2. THAT THE FAA CANVASS ALL CARRIERS, SUBJECT TO THE PROVISIONS OF SECTION 121.317 (A) WITH A VIEW TOWARD ASSURING READILY VISIBLE WARNING SIGNS AT ALLSEATING POSITIONS.

SOURCE OF RECOMMENDATION: UNITED AIR LINES, INC.,
720 SERIES,
JANESVILLE, WISCONSIN,
July 26, 1969

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-70-045, September 10, 1970
REQUIRE THAT THE ITEM "WARN PASSENGERS" BE INSERTED AS ONE OF THE LAST ITEMS ON THE EMERGENCY LANDING OR DITCHING CHECKLISTS OF ALL CARRIERS, YET SUFFICIENTLY ADVANCED ON THE LIST TO INSURE ADEQUATE TIME FOR PASSENGERS TO BRACE FOR A CRASH.

SOURCE OF RECOMMENDATION: ANTILLIAANSE LUCHTVAART MAATSCHAPPIJ (ALM),
DC-9 SERIES,
ST. CROIX, VIRGIN ISLANDS,
May 2, 1970

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-70-055, October 29, 1970
THE FAA INSURE THAT NO FLIGHT REQUIRING THE BRIEFING OF PASSENGERS REGARDING EMERGENCY PROCEDURES BE DISPATCHED WITHOUT AN OPERABLE PUBLIC ADDRESS SYSTEM. THE SYSTEM SHOULD BE FUNCTIONING SO THAT THE FLIGHT DECK CREW CAN SPEAK TO THE PASSENGERS AND A CABIN ATTENDANT CAN SPEAK TO THE PASSENGERS FROM AT LEAST ONE CABIN STATION.

SOURCE OF RECOMMENDATION: ANTILLIAANSE LUCHTVAART MAATSCHAPPIJ (ALM),
DC-9 SERIES,
ST. CROIX, VIRGIN ISLANDS,
May 2, 1970

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-71-018, April 12, 1971
THE FEDERAL AVIATION ADMINISTRATION INSTITUTE APPROPRIATE REGULATORYACTION TO PROHIBIT THE SERVICING OF OXYGEN SYSTEMS WHILE PASSENGERS ARE ON BOARD.

SOURCE OF RECOMMENDATION: UNITED AIR LINES, INC.,
737 SERIES,
WASHINGTON, DISTRICT OF COLUMBIA,
December 31, 1970

STATUS: CLOSED - UNACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-71-044, October 5, 1971
CANVASS AIR CARRIERS TO DOCUMENT THE SERVICE PROBLEMS FOUND WITH THECABIN INTERPHONE SYSTEM INSTALLED IN THE BOEING 747 WITH A VIEW TO ELIMINATING SUCH CONDITIONS AS LOOSE AND IMPROPERLY PLACED HANDSETS,DIALING DELAYS, AND OTHER SYSTEM LIMITATIONS.

SOURCE OF RECOMMENDATION: PAN AMERICAN WORLD AIRWAYS, INC.,
747 SERIES,
February 7, 1971

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-71-045, October 5, 1971
REQUIRE AN INDEPENDENT MEANS FOR ACCESS TO THE PUBLIC ADDRESS SYSTEMAT THE CABIN ATTENDANT STATIONS IN TRANSPORT AIRCRAFT IN GENERAL ANDTHE BOEING 747 IN PARTICULAR.

SOURCE OF RECOMMENDATION: PAN AMERICAN WORLD AIRWAYS, INC.,
747 SERIES,
February 7, 1971

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-72-065, June 28, 1972
EXPEDITE THE DEVELOPMENT OF THE SLIDE- RAFT COMBINATION AND REQUIRE INSTAL- LATION OF THIS DEVICE ON ALL U.S. AIR CARRIER AIRCRAFT AT AN EARLY DATE.

SOURCE OF RECOMMENDATION: OVERSEAS NATIONAL AIRWAYS, INC.,
DC-9 SERIES,

SOURCE OF RECOMMENDATION: ANTILLIAANSE LUCHTVAART MAATSCHAPPIJ (ALM),
ST. CROIX, VIRGIN ISLANDS,
May 2, 1970

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-72-067, June 28, 1972
AMEND FAR PART 129, "OPERATIONS OF FOREIGN AIR CARRIERS," TO INCLUDE THE SAFETY PROVISIONS OF SUBPART T OF PART 121 GOVERNING THE BRIEFING OF PASSEN- GERS, OR INCLUDE THESE PROVISIONS IN THE OPERATIONS SPECIFICATIONS ISSUED TO FOREIGN AIR CARRIERS BY THE ADMINISTRA- TOR; AND REQUIRE THAT APPROVED WORDING FOR SUCH BRIEFINGS BE INCLUDED IN THE APPROPRIATE FLIGHT/OPERATIONS MANUALS OF THE APPLICABLE CREWMEMBERS.

SOURCE OF RECOMMENDATION: OVERSEAS NATIONAL AIRWAYS, INC.,
DC-9 SERIES,

SOURCE OF RECOMMENDATION: ANTILLIAANSE LUCHTVAART MAATSCHAPPIJ (ALM),
ST. CROIX, VIRGIN ISLANDS,
May 2, 1970

STATUS: CLOSED - UNACCEPTABLE ACTION

RECOMMENDATION: A-72-068, June 28, 1972
COLLABORATE WITH THE AIR TRANSPORT ASSOCIATION IN THE DEVELOPMENT OF MORE EFFECTIVE METHODS FOR CONVEYING SAFETY INFORMATION TO PASSENGERS. RESEARCH SHOULD BE CONDUCTED IN THE APPLICATION OF COMMUNICATION TECHNIQUES, BEHAVIORAL SCIENCES, AND OPTIMUM LEARNING SITUATIONS. THE RECENT ADVANCES IN AUDIO-VISUAL TECHNIQUES SHOULD ALSO BE EXPLORED.

SOURCE OF RECOMMENDATION: OVERSEAS NATIONAL AIRWAYS, INC.,
DC-9 SERIES,

SOURCE OF RECOMMENDATION: ANTILLIAANSE LUCHTVAART MAATSCHAPPIJ (ALM),
ST. CROIX, VIRGIN ISLANDS,
May 2, 1970

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-72-072, June 28, 1972
THE AIR TRANSPORT ASSOCIATION COLLABORATE WITH FOREIGN CARRIERS, THROUGH THE INTERNATIONAL AIR TRANSPORT ASSOCIATION, IN THE STANDARDIZATION OF METHODS FOR CONVEYING SAFETY INFORMATION TO PASSENGERS.

SOURCE OF RECOMMENDATION: OVERSEAS NATIONAL AIRWAYS, INC.,
DC-9 SERIES,

SOURCE OF RECOMMENDATION: ANTILLIAANSE LUCHTVAART MAATSCHAPPIJ (ALM),
ST. CROIX, VIRGIN ISLANDS,
May 2, 1970

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-72-084, July 6, 1972
REQUIRE SELF-ILLUMINATING HANDLES FOR ALL TYPE I AND TYPE A EXITS.

SOURCE OF RECOMMENDATION: July 6, 1972

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-72-127, August 25, 1972
REQUIRE THAT WHENEVER THE PASSENGER SEATBELT LIGHT IS TURNED ON, IRRESPECTIVE OF WHETHER OR NOT THE FLIGHT ATTENDANTS ARE PERFORMING PASSENGER SERVICE DUTIES, THEY SHALL IMMEDIATELY VISUALLY CHECK SEATBELTS AND REMIND THE PASSENGERS TO KEEP BELTS SNUGLY FASTENED.

SOURCE OF RECOMMENDATION: NATIONAL AIRLINES, INC.,
747 SERIES,
LAKE CHARLES, LOUISIANA,
January 4, 1972

STATUS: CLOSED - ACCEPTABLE ALTERNATE ACTION

RECOMMENDATION: A-72-128, August 28, 1972
FEDERAL AVIATION REGULATION 121.571 BE REVISED TO STATE THAT THE APPROPRIATE CREWMEMBER MUST PHYSICALLY POINT OUT THE LOCATION OF ALLEMERGENCY EXITS ON EACH AIRCRAFT PRIOR TO EACH TAKEOFF. AS A GENERALRULE PASSENGERS DO NOT LISTEN TO THE ORAL ANNOUNCEMENTS. THIS WAS TESTIFIED TO DURING THE PUBLIC HEARING RELATIVE TO THIS ACCIDENT. HOWEVER, PASSENGERS WILL TEND TO WATCH A FLIGHT ATTENDANT WHO PHYSICALLY POINTS OUT THE AREA OF EXITS AND WILL RETAIN THEREFORE A GENERAL IDEA OF THE LOCATION OF SUCH EXITS PARTICULARLY THOSE NEAREST TO THEM.

SOURCE OF RECOMMENDATION: ALLEGHENY AIRLIENS, INC.,
580 SERIES,
NEW HAVEN, CONNECTICUT,
June 7, 1971

STATUS: CLOSED - UNACCEPTABLE ACTION

RECOMMENDATION: A-72-131, August 28, 1972

PREVIOUSLY EFFECTIVE FEDERAL AVIATION REGULATION 121.391, "FLIGHT ATTENDANTS," REQUIRING TWO FLIGHT ATTENDANTS FOR MORE THAN 44 PASSENGERS BE REINSTATED WITHOUT ANY WAIVERS, EXEMPTIONS OR DEVIATIONS (AS ALLOWED UNDER EXEMPTION 1108B). AS WE HAVE PREVIOUSLYPOINTED OUT IN OUR COMMENTS REGARDING NOTICE OF PROPOSED RULE MAKING70-35 (SEE APPENDIX J), THE BOARD DID NOT RECOMMEND A PERMANENT RULECHANGE BUT RATHER THAT THE PARTIAL EXEMPTION SHOULD BE EXTENDED FOR A PERIOD OF TIME DURING WHICH A PROGRAM FOR COLLECTION OF APPROPRIATE DATA CAN BE ACCOMPLISHED. THE EXEMPTION ALLOWED CERTAIN CARRIERS TO OPERATE A 50-PASSENGER AIRCRAFT WITH ONE FLIGHT ATTENDANT FOR A 44-PASSENGER SEATING CAPACITY AND TWO FLIGHT ATTENDANTS FOR A 44- TO 99-PASSENGER SEATING CAPACITY. FLIGHT ATTENDANTS SHOULD BE SO DISTRIBUTED WITHIN THE CABIN OF THE CV-580 SO AS TO ASSURE SAFE EVACUATION OF PASSENGERS SHOULD THE INJURY OR FATALITY OF ONE FLIGHT ATTENDANT DURING THE IMPACT SEQUENCE RENDER HER PARTIALLY OR FULLY INCAPACITATED. AS DEMONSTPATED IN THIS ACCIDENT, TWO FLIGHT ATTENDANTS, OFFERING LEADERSHIP AND ASSISTANCE FROM ALL AVAILABLE WINDOW EXITS AND THE MAIN CABIN DOOR, WOULD EXPEDITE ANY EVACUATION.

SOURCE OF RECOMMENDATION: ALLEGHENY AIRLIENS, INC.,
580 SERIES,
NEW HAVEN, CONNECTICUT,
June 7, 1971

STATUS: CLOSED - UNACCEPTABLE ACTION

RECOMMENDATION: A-72-132, August 28, 1972
THE INSTRUCTIONS FOR OPENING THE CONVAIR 580 REAR SERVICE DOOR WHICHARE PRESENTLY AFFIXED TO THIS DOOR SHOULD BE SUBJECTED TO A THOROUGHSTUDY AND REEVALUATION. THE PRESENT INSTRUCTIONS ARE MISLEADING. SIMPLE AND CLEAR LANGUAGE SHOULD BE SUBSTITUTED, SUCH AS "REMOVE PLASTIC COVER, OPEN DOOR, PULL RED INFLATE CORD." ADDITIONALLY, THE LOCKING MECHANISM (WHICH IS EASILY MISTAKEN FOR A DOOR HANDLE) SHOULD BE COVERED WITH AN OPAQUE LIGHT-WEIGHT MATERIAL OR SOME OTHERDEVICE WHICH WOULD BLEND WITH THE CABIN INTERIOR MATERIAL AND COULD NOT BE MISTAKEN AS PART OF THE EGRESS SYSTEM IN AN EMERGENCY SITUATION. A COMPLETE MODIFICATION OF THE DOOR HANDLE TO SIMPLIFY ITS OPERATION SHOULD BE CONSIDERED AS AN ALTERNATE SOLUTION.

SOURCE OF RECOMMENDATION: ALLEGHENY AIRLIENS, INC.,
580 SERIES,
NEW HAVEN, CONNECTICUT,
June 7, 1971

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-72-133, August 28, 1972
PRESENT PROVISIONS FOR EMERGENCY EXIT LIGHTS FOR UTILIZATION DURING DARKNESS OR SMOKE CONDITIONS BE EVALUATED. DURING DARKNESS OR SMOKE CONDITIONS, IT IS VITALLY IMPORTANT TO HAVE SOME FORM OF LIGHT AVAILABLE TO DIRECT AND CONDUCT EMERGENCY EVACUATIONS AS WELL AS TO READ OPERATING INSTRUCTIONS. SURVIVING PASSENGERS INDICATED THAT THECABIN WAS DARK, AND EXITS WERE DIFFICULT TO SEE.

SOURCE OF RECOMMENDATION: ALLEGHENY AIRLIENS, INC.,
580 SERIES,
NEW HAVEN, CONNECTICUT,
June 7, 1971

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-72-135, August 28, 1972
ADEQUATE SHOULDER HARNESSES BE PROVIDED ON ALL AIRPLANES FOR THE FLIGHT ATTENDANTS AT THEIR ASSIGNED SEATS. THIS WOULD GIVE ADDED PROTECTION, ASSURE SURVIVAL AND PREVENT ADDITIONAL INJURIES TO FLIGHT ATTENDANTS AND ASSURE LEADERSHIP FOR PASSENGER EVACUATION.

SOURCE OF RECOMMENDATION: ALLEGHENY AIRLIENS, INC.,
580 SERIES,
NEW HAVEN, CONNECTICUT,
June 7, 1971

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-72-136, August 28, 1972
THE EMERGENCY INSTRUCTIONS FOR THE INDIVIDUAL AIRPLANE BE DISPLAYED ON THE BACK OF THE SEATS IN EYE LEVEL SIGHT OF THE PASSENGER, TO PROVIDE ADDED ASSURANCE THAT THE PASSENGER IS FULLY AWARE OF VITAL SAFETY AND SURVIVAL INFORMATION. EFFORTS SHOULD ALSO BE EXERTED BY THE INDUSTRY IN COOPERATION WITH REGULATORY AND CONSUMER PROTECTION AGENCIES TO ASCERTAIN THAT ALL VITAL SAFETY INFORMATION BE DISSEMINATED TO THE TRAVELING PUBLIC IN A STRAIGHTFORWARD, CLEAR, AND EXPLICIT MANNER.

SOURCE OF RECOMMENDATION: ALLEGHENY AIRLIENS, INC.,
580 SERIES,
NEW HAVEN, CONNECTICUT,
June 7, 1971

STATUS: CLOSED - RECONSIDERED

RECOMMENDATION: A-72-141, August 31, 1972
THE FAA REQUIRE ALL AIR CARRIER AIRCRAFT TO BE EQUIPPED WITH AN AUDIO AND VISUAL EVACUATION ALARM SYSTEM. THIS SYSTEM SHOULD BE CAPABLE OF BEING ACTIVATED IN THE COCKPIT AND AT EACH FLIGHT ATTENDANT'S STATION. THE ALARM SYSTEM SHOULD BE SELF-POWERED SO THATINTERRUPTION OF THE AIRCRAFT ELECTRICAL SYSTEMS WILL NOT INTERFERE WITH USE OF THE EVACUATION ALARM.

SOURCE OF RECOMMENDATION: PAN AMERICAN WORLD AIRWAYS, INC.,
747 SERIES,
SAN FRANCISCO, CALIFORNIA,
July 30, 1971

STATUS: CLOSED - UNACTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-72-142, August 31, 1972
THE FAA REVIEW THE SLIDE PACK MOUNTING DESIGN, GAS GENERATOR RETENTION DESIGN, AND THE PROTECTION OF THE WHEELWELL MOUNTED GAS GENERATOR INSTALLATION. THIS REVIEW SHOULD BE MADE TO DETERMINE WHATACTIONS CAN BE TAKEN TO IMPROVE THESE COMPONENTS AND MAKE THEM MORE RELIABLE.

SOURCE OF RECOMMENDATION: PAN AMERICAN WORLD AIRWAYS, INC.,
747 SERIES,
SAN FRANCISCO, CALIFORNIA,
July 30, 1971

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-72-143, August 31, 1972
THE FAA TAKE ADDITIONAL STEPS TO ENSURE THAT ALL CABIN CREWMEMBERS ARE PROPERLY INFORMED REGARDING THE SAFETY EQUIPMENT INSTALLED IN THE CABIN AND THAT THE EMERGENCY EQUIPMENT USED FOR PASSENGER DEMONSTRATION IS THE SAME AS THAT PROVIDED FOR THE PASSENGERS' USE.

SOURCE OF RECOMMENDATION: PAN AMERICAN WORLD AIRWAYS, INC.,
747 SERIES,
SAN FRANCISCO, CALIFORNIA,
July 30, 1971

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-73-003, May 23, 1973
AMEND SECTION 121.317 OF THE FEDERAL AVIATION REGULATIONS TO REQUIRETHAT SEATBELT SIGNS BE LEGIBLE TO EACH PERSON, WHETHER HE IS SEATED OR STANDING, LOCATED IN GALLEYS, LOUNGES, LAVATORIES, OR LAVATORY WAITING AREAS.

SOURCE OF RECOMMENDATION: AAS-73-1, May 23, 1973

STATUS: CLOSED - RECONSIDERED

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-73-004, May 23, 1973
REQUIRE THAT "LAVATORY OCCUPIED" SIGNS BE INSTALLED. THESE SIGNS SHOULD BE OF SUFFICIENT SIZE, COLOR, AND BRIGHTNESS AS TO BE LEGIBLETO ALL PERSONS IN THE CABIN, WHETHER THE PERSONS ARE SEATED OR STANDING.

SOURCE OF RECOMMENDATION: AAS-73-1, May 23, 1973

STATUS: CLOSED - RECONSIDERED

RECOMMENDATION: A-73-006, May 23, 1973
THE NATIONAL TRANSPORTATION BOARD RECOMMENDS THAT THE AIR TRANSPORT ASSOCIATION OF AMERICA AND MEMBER AIR CARRIERS: INITIATE A STUDY TO DEVELOP INNOVATIVE METHODS FOR INFORMING PASSENGERS OF SAFETY EQUIPMENT AND SEATBELT USAGE. THE WORK OF DOUGLAS AIRPLANE DIVISION,MCDONNELL DOUGLAS CORPORATION, MAY SERVE AS A GUIDE TO THE MORE EFFECTIVE TECHNIQUES FOR PRESENTING PASSENGER SAFETY INFORMATION.

SOURCE OF RECOMMENDATION: AAS-73-1, May 23, 1973

STATUS: CLOSED - ACCEPTABLE ALTERNATE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-73-014, May 18, 1973
THE FEDERAL AVIATION ADMINISTRATION TAKE ACTION TO ENSURE THAT THE ARMING OF THE EMERGENCY CABIN LIGHTING BE INCLUDED IN CHECKLISTS USED BEFORE EACH TAKEOFF AND LANDING.

SOURCE OF RECOMMENDATION: MOHAWK AIRLINES INC.,
FH-227B SERIES,
ALBANY, NEW YORK,
March 3, 1972

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-73-041, June 25, 1973
AMEND 14 CFR 25.812 TO REQUIRE PROVISIONS FOR THE STOWAGE OF A PORTABLE, HIGH-INTENSITY LIGHT AT CABIN ATTENDANT STATIONS; AND AMEND 14 CFR 121.310 TO REQUIRE THE INSTALLATION OF SUCH PORTABLE, HIGH-INTENSITY LIGHTS AT CABIN ATTENDANT STATIONS.

SOURCE OF RECOMMENDATION: NORTH CENTRAL AIRLINES, INC.,
DC-9 SERIES,

SOURCE OF RECOMMENDATION: UNITED AIR LINES, INC.,
737 SERIES,

SOURCE OF RECOMMENDATION: EASTERN AIR LINES, INC.,
L-1011 SERIES,
CHICAGO, ILLINOIS,
December 20, 1972

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-73-042, June 25, 1973
AMEND 14 CFR 25.812 TO REQUIRE EXIT SIGN BRIGHTNESS AND GENERAL ILLUMINATION LEVELS IN THE PASSENGER CABIN THAT ARE CONSISTENT WITH THOSE NECESSARY TO PROVIDE ADEQUATE VISIBILITY IN CONDITIONS OF DENSE SMOKE.

SOURCE OF RECOMMENDATION: NORTH CENTRAL AIRLINES, INC.,
DC-9 SERIES,

SOURCE OF RECOMMENDATION: UNITED AIR LINES, INC.,
737 SERIES,

SOURCE OF RECOMMENDATION: EASTERN AIR LINES, INC.,
L-1011 SERIES,
CHICAGO, ILLINOIS,
December 20, 1972

STATUS: CLOSED - UNACCEPTABLE ACTION

RECOMMENDATION: A-73-043, June 25, 1973
AMEND 14 CFR 25.812 TO PROVIDE AN ADDITIONAL MEANS FOR ACTIVATING THE MAIN EMERGENCY LIGHTING SYSTEM TO PROVIDE REDUDANCY AND THEREBY IMPROVE ITS RELIABILITY.

SOURCE OF RECOMMENDATION: NORTH CENTRAL AIRLINES, INC.,
DC-9 SERIES,

SOURCE OF RECOMMENDATION: UNITED AIR LINES, INC.,
737 SERIES,

SOURCE OF RECOMMENDATION: EASTERN AIR LINES, INC.,
L-1011 SERIES,
CHICAGO, ILLINOIS,
December 20, 1972

STATUS: CLOSED - UNACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-73-053, August 10, 1973
AMEND THE EXISTING CERTIFICATION AND OPERATING RULES FOR AIR CARRIER AND AIR TAXI AIRCRAFT TO INCLUDE PROVISIONS REQUIRING TACTILE GUIDANCE AND IMPROVED VISUAL GUIDANCE TO EMERGENCY EXITS, ASWELL AS MORE EFFICIENT METHODS OF INDICATING THE LOCATION OF EMERGENCY EXITS IN A DARK OR SMOKE ENVIRONMENT.

SOURCE OF RECOMMENDATION: NORTH CENTRAL AIRLINES, INC.,
DC-9 SERIES,

SOURCE OF RECOMMENDATION: DELTA AIR LINES, INC.,
880 SERIES,

SOURCE OF RECOMMENDATION: EASTERN AIR LINES, INC.,
L-1011 SERIES,
CHICAGO, ILLINOIS,
December 20, 1972

STATUS: CLOSED - ACCEPTABLE ALTERNATE ACTION

RECOMMENDATION: A-74-102, December 4, 1974
AMEND 14 CFR 25.772 TO REQUIRE THAT PILOT COMPARTMENT DOORS BE DESIGNED TO PROVIDE A MEANS FOR THE COCKPIT CREW TO EGRESS THROUGH THE DOORWAY TO THE CABIN, EVEN IF THE DOOR BECOMES JAMMED.

SOURCE OF RECOMMENDATION: TRANS WORLD AIRLINES, INC.,
707 SERIES,
LOS ANGELES, CALIFORNIA,
January 16, 1974

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-74-103, December 4, 1974
AMEND 14 CFR 121.313 TO REQUIRE THAT, AFTER A REASONABLE DATE, A MEANS BE PROVIDED FOR THE COCKPIT CREW TO EXIT THROUGH THE PILOT COMPARTMENT DOOR TO THE CABIN EVEN IF THE DOOR BECOMES JAMMED.

SOURCE OF RECOMMENDATION: TRANS WORLD AIRLINES, INC.,
707 SERIES,
LOS ANGELES, CALIFORNIA,
January 16, 1974

STATUS: CLOSED - UNACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-74-105, January 5, 1975
REQUIRE THAT AIR CARRIERS REPORT ALL EMERGENCY EVACUATION SLIDE DEPLOYMENTS, FAILURES, AND MALFUNCTIONS TO THE FAA.

SOURCE OF RECOMMENDATION: AAS-74-3, January 5, 1975

STATUS: CLOSED - UNACCEPTABLE ACTION

RECOMMENDATION: A-74-106, January 5, 1975
DEVELOP A MAINTENANCE SURVEILLANCE PROGRAM TO INSURE GREATER RELIABILITY OF EMERGENCY EVACUATION SLIDE SYSTEMS.

SOURCE OF RECOMMENDATION: AAS-74-3, January 5, 1975

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-74-107, January 5, 1975
AMEND 14 CFR 25.809 TO REQUIRE THAT THE LENGTH OF THE EMERGENCY EVACUATION SLIDES BE SUCH THAT THE ANGLE WITH THE GROUND RENDERS THE SLIDE SAFE AND USABLE AFTER COLLAPSE OF ONE LEG, OR MORE, OF THE LANDING GEAR, AND AMEND 14 CFR 121.310 TO REQUIRE THAT THESE NEW SLIDES BE INSTALLED AFTER A REASONABLE DATE.

SOURCE OF RECOMMENDATION: AAS-74-3, January 5, 1975

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-74-108, January 5, 1975
AMEND 14 CFR 121.310 TO REQUIRE, AFTER A REASONABLE DATE, THAT EMERGENCY EVACUATION SLIDES ON ALL FLOOR-LEVEL EXITS BE AUTOMATICALLY INFLATED UPON DEPLOYMENT.

SOURCE OF RECOMMENDATION: AAS-74-3, January 5, 1975

STATUS: CLOSED - UNACCEPTABLE ACTION

RECOMMENDATION: A-74-109, January 5, 1975
AMEND 14 CFR 25.812 TO REQUIRE THAT EXTERIOR EMERGENCY LIGHTING BE ACTIVATED AUTOMATICALLY WHEN EXITS ARE OPENED IN THE EMERGENCY MODE,AND AMEND 14 CFR 121.310 TO REQUIRE SUCH AUTOMATIC ACTIVATION AFTER SOME REASONABLE DATE.

SOURCE OF RECOMMENDATION: AAS-74-3, January 5, 1975

STATUS: CLOSED - UNACCEPTABLE ACTION

RECOMMENDATION: A-74-110, January 5, 1975
REQUIRE THAT THE AIR CARRIERS DESIGNATE THE FLIGHT ATTENDANT(S) WHO WILL BE RESPONSIBLE FOR USE OF THE MEGAPHONE(S) DURING AN EVACUATION, AND RELOCATE THE MEGAPHONE(S) SO THEY ARE WITHIN EASY REACH OF THAT FLIGHT ATTENDANT(S)' SEAT. CONSIDERATION SHOULD BE GIVEN TO THE INSTALLATION OF NEW, LIGHT AND COMPACT MEGAPHONES TO FACILITATE STOWAGE AND USE.

SOURCE OF RECOMMENDATION: AAS-74-3, January 5, 1975

STATUS: CLOSED - RECONSIDERED

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-74-111, January 5, 1975
AMEND 14 CFR 121.318 TO REQUIRE AFTER A REASONABLE DATE, THAT PUBLIC ADDRESS SYSTEMS BE CAPABLE OF OPERATING ON A POWER SOURCE INDEPENDENT OF THE MAIN AIRCRAFT POWER SUPPLY.

SOURCE OF RECOMMENDATION: AAS-74-3, January 5, 1975

STATUS: CLOSED - UNACCEPTABLE ACTION

RECOMMENDATION: A-74-112, January 5, 1975
REQUIRE THAT AIR CARRIER PASSENGERS BE ALERTED, DURING PRETAKEOFF BRIEFINGS, OF THE NEED TO FAMILIARIZE THEMSELVES WITH THE PROCEDURES INVOLVED IN THE OPERATION OF EMERGENCY EXITS.

SOURCE OF RECOMMENDATION: AAS-74-3, January 5, 1975

STATUS: CLOSED - ACCEPTABLE ALTERNATE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-74-113, January 5, 1975
ISSUE AN ADVISORY CIRCULAR WHICH WOULD PROVIDE STANDARDIZED GUIDANCE TO THE AIR TRANSPORT INDUSTRY ON EFFECTIVE METHODS AND TECHNIQUES FOR CONVEYING SAFETY INFORMATION TO PASSENGERS.

SOURCE OF RECOMMENDATION: AAS-74-3, January 5, 1975

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-75-060, July 31, 1975
ISSUE AN AIR CARRIER OPERATIONS BULLETIN REQUIRING PRINCIPAL OPERATIONS INSPECTORS TO ALERT THEIR ASSIGNED AIR CARRIERS TO THE IMPORTANCE OF ASSIGNING EMERGENCY DUTIES AND SEATING LOCATIONS TO EXTRA FLIGHT ATTENDANTS CARRIED ON BOARD AIRCRAFT IN EXCESS OF THE NUMBER REQUIRED BY 14 CFR 121.391 SO THAT THEY ARE MORE EVENLY DISTRIBUTED THROUGHOUT THE AIRCRAFT TO PROVIDE MORE EFFECTIVE GUIDANCE TO PASSENGERS AT MORE EXITS DURING AN EMERGENCY EVACUATION.

SOURCE OF RECOMMENDATION: AMERICAN WORLD AIRWAYS,
707 SERIES,
ANCHORAGE, ALASKA,
January 30, 1974

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-75-067, August 14, 1975
EVALUATE THE FEASIBILITY OF USING THE CITABRIA'S LEFT FRONT SIDE WINDOW AS AN ALTERNATE EMERGENCY EXIT.

SOURCE OF RECOMMENDATION: 7KCAB SERIES,
HILLSBORO, OREGON,
February 5, 1975

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-76-025, April 29, 1976
ISSUE AN ADVISORY CIRCULAR (AC) TO ALL PART 121, 123, AND 135.2 CERTIFICATE HOLDERS TO PROVIDE GUIDELINES FOR IMPROVED PASSENGER BRIEFINGS AND PRINTED INSTRUCTIONS FOR THE USE OF CHEMICAL SUPPLEMENTAL OXYGEN SYSTEMS.

SOURCE OF RECOMMENDATION: DC-10 SERIES,

SOURCE OF RECOMMENDATION: L-1011 SERIES,
April 29, 1976

STATUS: CLOSED - ACCEPTABLE ALTERNATE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-76-026, April 29, 1976
ISSUE AN OPERATIONS BULLETIN FOR A REVIEW OF ORAL BRIEFINGS AND PASSENGER SAFETY CARDS FOR EACH PART 121, 123, AND 135.2 CERTIFICATEHOLDER TO ASSURE THAT BRIEFINGS AND PRINTED INSTRUCTIONS FOR THE USEOF THE PASSENGER CHEMICAL SUPPLEMENTAL OXYGEN SYSTEM ARE FACTUAL ANDUNAMBIGUOUS AND CONFORM TO THE GUIDELINES OF THE ABOVE AC.

SOURCE OF RECOMMENDATION: DC-10 SERIES,

SOURCE OF RECOMMENDATION: L-1011 SERIES,
April 29, 1976

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-76-120, August 13, 1976
REQUIRE THAT THE MMELS OF PASSENGER-CARRYING AIRPLANES BE STANDARDIZED TO REQUIRE THAT THE P. A. SYSTEM BE OPERABLE FROM THE COCKPIT AND FROM AT LEAST ONE FLIGHT ATTENDANT STATION AT ALL TIMES.

SOURCE OF RECOMMENDATION: August 13, 1976

STATUS: OPEN - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-77-028, May 23, 1977
ISSUE AN AIR CARRIER OPERATIONS BULLETIN CLARIFYING THE DESIGNATION OF THE DC-9 TAIL CONE EXIT AS A REQUIRED EXIT AND REQUIRING THAT PRINCIPAL OPERATIONS INSPECTORS ASSIGNED TO DC-9 OPERATORS INSURE THAT THEIR ASSIGNED AIR CARRIERS PROVIDE INSTRUCTIONS IN THEIR PASSENGER BRIEFINGS AND ON THEIR PASSENGER INFORMATION CARDS ON THE AVAILABILITY AND OPERATION OF THE TAIL CONE EXIT AS AN EMERGENCY EXIT.

SOURCE OF RECOMMENDATION: TEXAS INTERNATIONAL AIRLINES, INC.,
DC-9 SERIES,
DENVER, COLORADO,
November 16, 1976

STATUS: CLOSED - ACCEPTABLE ALTERNATE ACTION

RECOMMENDATION: A-77-029, May 23, 1977
ISSUE AN AIRWORTHINESS DIRECTIVE TO REQUIRE THAT AN EMERGENCY LIGHT SOURCE BE LOCATED IN CLOSE PROXIMITY TO THE DC-9 TAIL CONE RELEASE HANDLE OR THAT THE HANDLE BE SELF-ILLUMINATING.

SOURCE OF RECOMMENDATION: TEXAS INTERNATIONAL AIRLINES, INC.,
DC-9 SERIES,
DENVER, COLORADO,
November 16, 1976

STATUS: CLOSED - ACCEPTABLE ALTERNATE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-79-016, May 1, 1979
THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: FUND AND GIVE HIGHEST PRIORITY TO AN EVACUATION SLIDE FABRIC TEST PROJECT WITH A VIEW TOWARD DEVELOPING AND CERTIFICATING FIRE-RESISTANT MATERIALS FOR THESE DEVICES.

SOURCE OF RECOMMENDATION: CONTINENTAL AIRLINES, INC.,
DC-10 SERIES,
LOS ANGELES, CALIFORNIA,
March 1, 1978

STATUS: OPEN - ACCEPTABLE ACTION

RECOMMENDATION: A-79-017, May 1, 1979
ISSUE AN AIRWORTHINESS DIRECTIVE REQUIRING THE STRENGTHENING OF THE GIRT FABRIC OF THE PICO 26-FOOT SLIDE/RAFT TO INSURE ITS RELIABILITY WHEN THE UNIT IS DEPLOYED AT ITS MOST CRITICAL ANGLE.

SOURCE OF RECOMMENDATION: CONTINENTAL AIRLINES, INC.,
DC-10 SERIES,
LOS ANGELES, CALIFORNIA,
March 1, 1978

STATUS: OPEN - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-79-018, May 1, 1979
AMEND TECHNICAL STANDARD ORDER C69 TO ADDRESS REQUIREMENTS FOR DUAL-LANE EVACUATION SLIDES AND TO REQUIRE CRITICAL ANGLE PERFORMANCE TESTING FOR THESE DEVICES.

SOURCE OF RECOMMENDATION: CONTINENTAL AIRLINES, INC.,
DC-10 SERIES,
LOS ANGELES, CALIFORNIA,
March 1, 1978

STATUS: OPEN - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-79-019, May 1, 1979
ISSUE A TECHNICAL STANDARD ORDER FOR SLIDE/RAFT DEVICES.

SOURCE OF RECOMMENDATION: CONTINENTAL AIRLINES, INC.,
DC-10 SERIES,
LOS ANGELES, CALIFORNIA,
March 1, 1978

STATUS: OPEN - ACCEPTABLE ACTION

RECOMMENDATION: A-79-020, May 1, 1979
AMEND 14 CFR 25.809 TO REQUIRE A SECONDARY MEANS OF ESCAPE AT ALL FLOOR-LEVEL CABIN EXITS CURRENTLY REQUIRING EMERGENCY ESCAPE SLIDES. THESE SECONDARY ESCAPE MEANS COULD BE ROPES OR OTHER MEANS DEMONSTRATED TO BE SUITABLE FOR EVACUATION PURPOSES.

SOURCE OF RECOMMENDATION: CONTINENTAL AIRLINES, INC.,
DC-10 SERIES,
LOS ANGELES, CALIFORNIA,
March 1, 1978

STATUS: CLOSED - NO LONGER APPLICABLE

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-79-037, June 1, 1979
AMEND 14 CFR 121.571 TO REQUIRE THAT PASSSENGERS BE BRIEFED ON THE LOCATION OF APPROVED FLOTATION DEVICES BEFORE EACH FLIGHT THAT REQUIRES THE AIRCRAFT TO PASS OVER A LARGE BODY OF WATER DURING TAKEOFF, DEPARTURE, APPROACH, OR LANDING.

SOURCE OF RECOMMENDATION: NATIONAL AIRLINES, INC.,
727 SERIES,
ESCAMBIA BAY, PENSACOLA, FLORIDA,
May 8, 1978

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-79-039, June 1, 1979
EXPEDITE THE ISSUANCE OF THE NOTICE OF PROPOSED RULE MAKING WHICH ADDRESSES REVISIONS TO TSO - C13C (14 CFR 37.123) FOR LIFEVESTS. THE REVISIONS TO THIS TSO SHOULD ELIMINATE THE DIFFICULTIES IDENTIFIED IN THIS ACCIDENT WITH RESPECT TO THE PACKAGING, DONNING, AND OPERATION OF LIFEVESTS BY UNINSTRUCTED SUBJECTS UNDER STRESS.

SOURCE OF RECOMMENDATION: NATIONAL AIRLINES, INC.,
727 SERIES,
ESCAMBIA BAY, PENSACOLA, FLORIDA,
May 8, 1978

STATUS: OPEN - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-79-062, August 24, 1979
THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: ISSUE AN AIR CARRIER MAINTENANCE BULLETIN CLARIFYING THE CONTENT OF 14 CFR 25.811(D) REGARDING THE CONSPICUITY OF PASSENGER EMERGENCY EXIT SIGNS WHEN EXITS ARE OPEN AND THE REQUIREMENT FOR EXIT SIGNS TO BE RELOCATED IN AIRCRAFT WHICH HAVE SIGNS AFFIXED ON THE EXIT CLOSURE.

SOURCE OF RECOMMENDATION: UNITED AIR LINES, INC.,
DC-8 SERIES,
PORTLAND, OREGON,
December 28, 1978

STATUS: CLOSED - ACCEPTABLE ALTERNATE ACTION

RECOMMENDATION: A-79-064, August 24, 1979
THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: EXPEDITE THE RELEASE OF OPERATIONS REVIEW PROGRAM NOTICE NO. 13 CONTAINING THE SAFETY BOARD'S 1974 RECOMMENDATION REGARDING A POWER SOURCE FOR PUBLIC ADDRESS SYSTEMS INDEPENDENT OF THE MAIN AIRCRAFT POWER SUPPLY IN PASSENGER CARRYING AIRCRAFT.

SOURCE OF RECOMMENDATION: UNITED AIR LINES, INC.,
DC-8 SERIES,
PORTLAND, OREGON,
December 28, 1978

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUAON/BRIEFINGS

RECOMMENDATION: A-81-028, March 20, 1981
THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: AMEND 14 CFR 23.783, 14 CFR 23.807(B)(3), AND 14 CFR PART 91 TO REQUIRE EXTERNAL DOORS AND EMERGENCY EXITS OF AIRCRAFT TO BE CONSPICUOUSLY MARKED ON THE OUTSIDE WITH DIRECTIONS FOR OPENING THE DOOR.

SOURCE OF RECOMMENDATION: PA-28 SERIES,
LAVINA, MONTANA,
June 4, 1977

STATUS: OPEN - ACCEPTABLE ACTION

RECOMMENDATION: A-81-129, September 30, 1981
AS A RESULT OF THIS SPECIAL INVESTIGATION, THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: REQUIRE THE INSTALLATION OF AN INDEPENDENTLY POWERED EVACUATION ALARM SYSTEM IN PASSENGER-CARRYING AIRCRAFT.

SOURCE OF RECOMMENDATION: UNITED AIR LINES, INC.,
DC-8 SERIES,
PHOENIX, ARIZONA,
December 29, 1980

STATUS: CLOSED - UNACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-81-130, September 30, 1981
AS A RESULT OF THIS SPECIAL INVESTIGATION, THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: PROMPTLY ADOPT THE FINAL RULE AS PROPOSED IN FAA'S NOTICE OF PROPOSED RULEMAKING NO. 81-1 — TO HAVE THE PUBLIC ADDRESS SYSTEM ON PASSENGER-CARRYING AIRCRAFT CAPABLE OF OPERATING FROM A POWER SOURCE INDEPENDENT OF THE MAIN ELECTRICAL GENERATING SYSTEM WITHOUT JEOPARDIZING THE IN-FLIGHT EMERGENCY ELECTRICAL POWER SYSTEM.

SOURCE OF RECOMMENDATION: UNITED AIR LINES, INC.,
DC-8 SERIES,
PHOENIX, ARIZONA,
December 29, 1980

STATUS: CLOSED - UNACCEPTABLE ACTION

RECOMMENDATION: A-81-131, September 30, 1981
AS A RESULT OF THIS SPECIAL INVESTIGATION, THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: AMEND THE MMEL'S FOR PASSENGER-CARRYING AIRCRAFT TO AIRCRAFT TO REQUIRE THAT THE PA SYSTEM BE OPERABLE FROM THE COCKPIT AND FROM AT LEAST ONE FLIGHT ATTENDANT STATION AT ALL TIMES. THESE AMENDMENTS SHOULD INCLUDE PROVISION THAT THE AIRCRAFT MAY CONTINUE THE FLIGHT OR SERIES OF FLIGHTS WITH OTHER PORTIONS OF THE SYSTEM INOPERATIVE FOR A REASONABLE NUMBER OF FLIGHT HOURS, BUT MAY NOT DEPART A STATION WHERE REPAIRS OR REPLACEMENTS CAN BE MADE.

SOURCE OF RECOMMENDATION: UNITED AIR LINES, INC.,
DC-8 SERIES,
PHOENIX, ARIZONA,
December 29, 1980

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-81-139, October 6, 1981
AS A RESULT OF SPECIAL STUDY NTSB-AAS-81-2, THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: ESTABLISH A SEPARATE SINGLE SUBPART IN 14 CFR 25 WHICH CONSOLIDATES CRASHWORTHINESS REQUIREMENTS FOR TRANSPORT CATEGORY AIRCRAFT PERTAINING [illegible] AREAS SUCH AS CRASH MODELS, OCCUPANT PROTECTION REQUIREMENTS, EMERGENCY EGRESS, RETENTION OF ITEMS OF MASS, AND SEAT AND SEAT RESTRAINT SYSTEMS.

SOURCE OF RECOMMENDATION: STATUS: OPEN - UNACCEPTABLE ACTION

RECOMMENDATION: A-81-150, November 9, 1981
THE NTSB URGES THE BUREAU ENQUETES ACCIDENTS TO TAKE ACTION TO ACHIEVE THE FOLLOWING: REQUIRE THE INCORPORATION INTO THE EMERGENCY SECTION OF THE AIRPLANE FLIGHT MANUAL FOR AIR FRANCE CONCORDE OPERATIONS, A PROCEDURE FOR SUSPECTED/KNOWN TIRE FAILURE ON TAKEOFF WHICH INCLUDES MANDATORY REQUIREMENT TO LEAVE THE LANDING GEAR EXTENDED, TO RETURN TO THE TAKEOFF AIRFIELD, TO ADVISE THE CABIN ATTENDANTS OF INTENDED ACTION, AND TO BRIEF PASSENGERS FOR A PRECAUTIONARY LANDING.

SOURCE OF RECOMMENDATION: AIR FRANCE,
CONCORDE,
DULLES AIRPORT, VIRGINIA,
June 14, 1979

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: EVACUATION/BRIEFINGS

RECOMMENDATION: A-83-045, July 12, 1983
THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: SPONSOR A GOVERNMENT/INDUSTRY TASK FORCE OPEN TO FOREIGN PARTICIPANTS MADE UP OF REPRESENTATIVES FROM THE AIRPLANE MANUFACTURERS, AIR CARRIER AND COMMUTER OPERATORS, RESEARCHERS, FLIGHT ATTENDANTS, AND CONSUMERS (1) TO IDENTIFY THE TYPE OF SAFETY INFORMATION THAT IS MOST USEFUL AND NEEDED BY PASSENGERS, (2) TO IDENTIFY AND DEVELOP IMPROVED INSTRUCTIONAL CONCEPTS FOR CONVEYING THE SAFETY INFORMATION, AND (3) TO RECOMMEND APPROPRIATE CHANGES TO THE OPERATING REQUIREMENTS REGARDING PASSENGER ORAL BRIEFINGS AND INFORMATION BRIEFING CARDS.

SOURCE OF RECOMMENDATION: SPANTEX,
DC-10 SERIES,
MALAGA, SPAIN,
September 13, 1982

STATUS: OPEN - AWAIT REPLY

AVIATION SAFETY RECOMMENDATIONS ON THE TOPIC OF
CREW EMERGENCY TRAINING AND CREW COORDINATION

RECOMMENDATION: A-72-069, June 28, 1972
THE FAA ESTABLISH REQUIREMENTS FOR INTERCARRIER CREW COMPOSITIONS TO AS- SURE THAT ADEQUATE TRAINING AND STANDARDIZATION OF EMERGENCY PROCEDURES HAVE BEEN ACCOMPLISHED IN ALL FACETS OF THE OPERATION.

SOURCE OF RECOMMENDATION: OVERSEAS NATIONAL AIRWAYS, INC.,
DC-9 SERIES,

SOURCE OF RECOMMENDATION: ANTILLIAANSE LUCHTVAART MAATSCHAPPIJ (ALM),
ST. CROIX, VIRGIN ISLANDS,
May 2, 1970

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: TRAINING/CREW COORDINATION

RECOMMENDATION: A-72-071, June 28, 1972
REQUIRE PERIODIC CREW TRAINING IN EVACUATION AND WET DITCHING DRILLS.

SOURCE OF RECOMMENDATION: OVERSEAS NATIONAL AIRWAYS, INC.,
DC-9 SERIES,

SOURCE OF RECOMMENDATION: ANTILLIAANSE LUCHTVAART MAATSCHAPPIJ (ALM),
ST. CROIX, VIRGIN ISLANDS,
May 2, 1970

STATUS: CLOSED - UNACCEPTABLE ACTION

RECOMMENDATION: A-72-073, June 28, 1972
ALL AIR CARRIERS MAKE A CRITICAL REVIEW OF THEIR CREW TRAINING PRACTICES AND MATERIALS WITH A VIEW TOWARD EXPANDING THEIR TRAINING IN THE AREAS OF CRASH SURVIVAL AND CREW LEADERSHIP AND ENSURING ADEQUATE RETENTION OF SUCH KNOWLEDGE.

SOURCE OF RECOMMENDATION: OVERSEAS NATIONAL AIRWAYS, INC.,
DC-9 SERIES,

SOURCE OF RECOMMENDATION: ANTILLIAANSE LUCHTVAART MAATSCHAPPIJ (ALM),
ST. CROIX, VIRGIN ISLANDS,
May 2, 1970

STATUS: CLOSED - NO LONGER APPLICABLE

TOPIC: TRAINING/CREW COORDINATION

RECOMMENDATION: A-72-130, August 28, 1972
SOME MEANS (EITHER LIGHTS OR LIGHTED SIGNS) BE INSTALLED AND USED ONTHE CV-580 FORWARD GALLEY TO ALLOW THE FLIGHT ATTENDANT VISUAL REFERENCE TO THE "NO SMOKING" SIGN. THIS WOULD INDICATE TO THE FLIGHT ATTENDANT THE NECESSITY TO SECURE HER GALLEY AND RETURN TO HER ASSIGNED SEAT.

SOURCE OF RECOMMENDATION: ALLEGHENY AIRLIENS, INC.,
580 SERIES,
NEW HAVEN, CONNECTICUT,
June 7, 1971

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-72-134, August 28, 1972
STANDARDIZED INSTRUCTIONS TO FLIGHT ATTENDANTS BE USED DURING TRAINING. THE PRACTICE OF USING THE MAIN CABIN DOOR FOR BOTH THE PLANNED AND UNPLANNED EMERGENCY TENDS TO CONFUSE THE FLIGHT ATTENDANTS. IT IS RECOMMENDED THAT THE SEQUENCE AND PROCEDURE FOR A PLANNED PRACTICE EMERGENCY BE IDENTICAL TO THAT WHICH IS TO BE USED IN ACTUAL EMERGENCY. IT IS FURTHER RECOMMENDED THAT THE ALLEGHENY AIRLINES HOSTESS MANUAL BE REVISED ACCORDINGLY.

SOURCE OF RECOMMENDATION: ALLEGHENY AIRLIENS, INC.,
580 SERIES,
NEW HAVEN, CONNECTICUT,
June 7, 1971

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: TRAINING/CREW COORDINATION

RECOMMENDATION: A-73-015, May 18, 1973
THE FEDERAL AVIATION ADMINISTRATION BRING THIS ACCIDENT TO THE ATTENTION OF APPROPRIATE FAA AND AIR CARRIER PERSONNEL. ESTABLISHED PILOT TRAINING PROGRAMS AND OPERATIONS MANUALS SHOULD BE REVISED TO INCLUDE GUIDANCE ON TIME AND TASK SHARING IN ABNORMAL AND EMERGENCY SITUATIONS. EMPHASIS SHOULD BE PLACED ON THE NEED OF PREPLANNING TASK AND TIME SHARING BY THE CREW BEFORE AN UNUSUAL OR EMERGENCY SITUATION ARISES.

SOURCE OF RECOMMENDATION: MOHAWK AIRLINES INC.,
FH-227B SERIES,
ALBANY, NEW YORK,
March 3, 1972

STATUS: CLOSED - UNACCEPTABLE ACTION

RECOMMENDATION: A-74-114, January 5, 1975
AMEND 14 CFR 121.417(C)(4) TO ELIMINATE THE PROVISION WHICH PERMITS CARRIERS TO USE DEMONSTRATIONS ALONE TO TRAIN CREWMEMBERS FOR CERTAIN EMERGENCY SITUATIONS, THUS REQUIRING PERFORMANCE OF DRILLS IN THE OPERATION AND USE OF EMERGENCY EXITS.

SOURCE OF RECOMMENDATION: AAS-74-3, January 5, 1975

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: TRAINING/CREW COORDINATION

RECOMMENDATION: A-75-084, November 23, 1975
REQUIRE AIR CARRIERS TO COMPLY WITH THE PROVISIONS OF 14 CFR 121.417(C) (4) BY THE USE OF ACCURATE AND REALISTIC EQUIPMENT AND PROCEDURES WHICH ACCURATELY SIMULATE EMERGENCY CONDITIONS, INCLUDINGTHE FORCES INVOLVED IN OPENING EXITS IN THE EMERGENCY MODE; AND REQUIRE THAT DURING EACH FLIGHT ATTENDANT'S INITIAL AND RECURRENT TRAINING HE OPERATE EMERGENCY EXITS WHICH DUPLICATE THE FORCES ENCOUNTERED AND ACTIONS NECESSARY WHEN SUCH EXITS ARE OPENED IN THE EMERGENCY MODE.

SOURCE OF RECOMMENDATION: WESTERN AIR LINES, INC.,
737 SERIES,
CASPER, WYOMING,
March 31, 1975

STATUS: OPEN - ACCEPTABLE ACTION

RECOMMENDATION: A-76-024, April 29, 1976
REQUIRE THAT OPERATORS OF AIRCRAFT HAVING THE CHEMICALLY GENERATED PASSENGER SUPPLEMENTAL OXYGEN SYSTEMS INCLUDE DETAILED INFORMATION REGARDING THE OPERATIONAL CHARACTERISTICS OF THESE SYSTEMS IN THE TRAINING PROGRAMS FOR THEIR COCKPIT AND CABIN CREWMEMBERS. SUCH INFORMATION SHOULD INCLUDE FLOW RATES AND THE TIME AND VOLUME LAG INTHE DELIVERY OF OXYGEN. (CLASS II - PRIORITY FOLLOWUP)

SOURCE OF RECOMMENDATION: DC-10 SERIES,

SOURCE OF RECOMMENDATION: L-1011 SERIES,
April 29, 1976

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: TRAINING/CREW COORDINATION

RECOMMENDATION: A-76-073, June 9, 1976
REQUIRE MODIFICATION OF CONTINENTAL AIR LINES' FLIGHTCREW EMERGENCY EVACUATION TRAINING PROGRAM TO INSURE THAT ADEQUATE EMPHASIS IS PLACED ON THE ASPECTS OF CREW COORDINATION, TEAM EFFORT, AND AWARENESS OF INDIVIDUAL CREWMEMBER'S RESPONSIBILITIES AS LEADERS OF AN EVACUATION.

SOURCE OF RECOMMENDATION: CONTINENTAL AIRLINES, INC.,
727 SERIES,
DENVER, COLORADO,
August 7, 1975

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-76-074, June 9, 1976
ISSUE AN AIR CARRIER OPERATIONS BULLETIN TO REQUIRE THAT PRINCIPAL OPERATIONS INSPECTORS REVIEW THE EMERGENCY EVACUATION TRAINING PROGRAMS OF THEIR ASSIGNED AIR CARRIERS TO INSURE THAT ADEQUATE EMPHASIS IS PLACED ON THE ASPECTS OF CREW COORDINATION, TEAM EFFORT,AND AWARENESS OF INDIVIDUALS' RESPONSIBILITIES AS LEADERS OF AN EVACUATION.

SOURCE OF RECOMMENDATION: CONTINENTAL AIRLINES, INC.,
727 SERIES,
DENVER, COLORADO,
August 7, 1975

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: TRAINING/CEW COORDINATION

RECOMMENDATION: A-76-075, June 9, 1976
REQUIRE THAT THE FLIGHTCREW MANUALS AND THE FLIGHT ATTENDANT MANUALSOF ALL AIR CARRIERS INCLUDE THE EVACUATION DUTY ASSIGNMENTS OF THE ENTIRE CREW.

SOURCE OF RECOMMENDATION: CONTINENTAL AIRLINES, INC.,
727 SERIES,
DENVER, COLORADO,
August 7, 1975

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-76-132, October 7, 1976
AMEND 14 CFR 121.584 TO INCLUDE PROVISIONS RELEVANT TO CARRIAGE OF MENTAL PATIENTS WHO ARE POTENTIALLY DANGEROUS TO THEMSELVES OR TO OTHERS. THESE PROVISIONS SHOULD INCLUDE THE REQUIREMENT THAT THE MENTAL PATIENT BE ACCOMPANIED BY A QUALIFIED MEDICAL ATTENDANT.

SOURCE OF RECOMMENDATION: EASTERN AIR LINES, INC.,
L-1011 SERIES,
SAN JUAN,
July 16, 1976

STATUS: OPEN - ACCEPTABLE ALTERNATE ACTION

TOPIC: TRAINING/CREW COORDINATION

RECOMMENDATION: A-76-133, October 7, 1976
AMEND ADVISORY CIRCULAR 121-18 TO PROVIDE GUIDANCE TO ORGANIZATIONS AND PERSONS RESPONSIBLE FOR THE TRANSPORTATION MENTAL PATIENTS WITH REGARD TO THE ACTIONS NECESSARY AND THE RESPONSIBILITIES INVOLVED IN ESCORTING SUCH PERSONS.

SOURCE OF RECOMMENDATION: EASTERN AIR LINES, INC.,
L-1011 SERIES,
SAN JUAN,
July 16, 1976

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-77-026, May 23, 1977
REQUIRE THAT THE EMERGENCY EVACUATION TRAINING PROGRAM OF ALL DC-9 OPERATORS COMPLY WITH THE INTENT OF 14 CFR 121.417, SPECIFICALLY WITH REGARD TO TRAINING IN THE OPERATION OF THE TAIL CONE EXIT.

SOURCE OF RECOMMENDATION: TEXAS INTERNATIONAL AIRLINES, INC.,
DC-9 SERIES,
DENVER, COLORADO,
November 16, 1976

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: TRAINING/CREW COORDINATION

RECOMMENDATION: A-79-035, June 1, 1979
ISSUE AN AIR CARRIER OPERATIONS BULLETIN REQUESTING PRINCIPAL OPERATIONS INSPECTORS TO INSURE THAT AIR CARRIER TRAINING PROGRAMS INCLUDE INSTRUCTIONS TO CREWMEMBERS WITH RESPECT TO THE AVAILABILITY, CAPABILITIES, AND USE OF FLOTABLE SEAT CUSHIONS ON THEIR AIRCRAFT.

SOURCE OF RECOMMENDATION: NATIONAL AIRLINES, INC.,
727 SERIES,
ESCAMBIA BAY, PENSACOLA, FLORIDA,
May 8, 1978

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-79-066, August 24, 1979
THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: ISSUE AN AIR CARRIER OPERATIONS BULLETIN WHICH WILL PROVIDE GUIDANCE AND CRITERIA TO FAA INSPECTORS IN DETERMINING THE SCOPE, QUALITY, AND EFFECTIVENESS OF TRAINING PROGRAMS WITH RESPECT TO COMMUNICATION AND COORDINATION AMONG CREWMEMBERS.

SOURCE OF RECOMMENDATION: UNITED AIR LINES, INC.,
DC-8 SERIES,
PORTLAND, OREGON,
December 28, 1978

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: TRAINING/CREW COORDINATION

RECOMMENDATION: A-81-061, June 3, 1981
THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATON: REQUIRE THAT AIR CARRIERS OPERATING APPLICABLE BOEING 727 AIRCRAFT INCLUDE EMERGENCY PROCEDURES FOR OPERATION OF THE VENTRAL AIRSTAIR DOOR IN THEIR TRAINING PROGRAMS FOR CABIN CREWS.

SOURCE OF RECOMMENDATION: CONTINENTAL AIRLINES/AIR MICRONESIA, INC.,
727 SERIES,
YAP, WESTERN CAROLINE ISL, CAROLINE ISLANDS,
November 21, 1980

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-81-127, September 21, 1981
THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: REVIEW DC-10 OPERATOR TRAINING PROGRAMS FOR FLIGHT ATTENDANT PERSONNEL AND FLIGHTCREWS TO ASSURE THAT THEY INCLUDE A DESCRIPTION AND DISCUSSION OF THE GALLEY LIFT SYSTEM INCLUDING THE ELECTRICAL CIRCUITRY, LOCATION OF CIRCUIT BREAKERS, FUNCTION OF DOOR INTERLOCK SWITCHES, AND EMERGENCY OPERATING PROCEDURES.

SOURCE OF RECOMMENDATION: WORLD AIRWAYS, INC.,
DC-10 SERIES,
BWI AIRPORT, BALTIMORE, MARYLAND,
September 19, 1981

STATUS: CLOSED - ACCEPTABLE ACTION

TOPIC: TRAINING/CREW COORDINATION

RECOMMENDATION: A-81-151, November 9, 1981
THE NTSB URGES THE BUREAU ENQUETES ACCIDENTS TO TAKE ACTION TO ACHIEVE THE FOLLOWING: DIRECT THE DEVELOPMENT AND ADOPTION BY AIR FRANCE OF TRAINING PLANS WHICH STRESS FLIGHT AND CABIN CREW COORDINATION PRIOR TO PRECAUTIONARY OR ABNORMAL LANDINGS.

SOURCE OF RECOMMENDATION: AIR FRANCE,
CONCORDE,
DULLES AIRPORT, VIRGINIA,
June 14, 1979

STATUS: CLOSED - ACCEPTABLE ACTION

RECOMMENDATION: A-82-098, August 26, 1982
THE NTSB RECOMMENDS THAT THE FEDERAL AVIATION ADMINISTRATION: ISSUE AN AIR CARRIER OPERATIONS BULLETIN REQUIRING PRINCIPAL OPERATIONS INSPECTORS TO REVIEW AND TO REQUIRE AS NECESSARY, MODIFICATION OF, THE OPERATIONS MANUALS OF ALL AIR CARRIERS TO ASSURE SAFE AND EFFECTIVE COORDINATION BETWEEN FLIGHT AND CREW. THE FOLLOWING SAFE OPERATING PROCEDURES SHOULD BE ADDRESSED:
(1) FLIGHT CREW PREDEPARTURE BRIEFINGS OF THE SENIOR FLIGHT ATTENDANT TO INCLUDE FORECAST TURBULENCE-RELATED WEATHER CONDITIONS, SCHEDULING OF CABIN SERVICES AND CLEANUP, AND SECURING OF GALLEYS, CABIN, AND PASSENGERS.
(2) FLIGHT CREW PUBLIC ADDRESS ANNOUNCEMENTS TO FOREWARN FLIGHT ATTENDANTS AND PASSENGERS OF ANTICIPATED IN-FLIGHT TURBULENCE AND TO REQUIRE FLIGHT ATTENDANTS TO CEASE IN-FLIGHT SERVICE AND TO BE SEATED WITH THEIR RESTRAINTS FASTENED WHEN TURBULENCE PENETRATION IS EXPECTED AND THE INTENSITY IS FORECAST TO BE "MODERATE" OR GREATER, AS DEFINED IN AVIATION WEATHER SERVICE, AC 00-45B, OR WHEN TURBULENCE IS ENCOUNTERED.

SOURCE OF RECOMMENDATION: UNITED AIRLINES,
737,
NEWPORT NEWS, VIRGINIA,
February 10, 1981

STATUS: OPEN - ACCEPTABLE ACTION

Mr. LEVITAS. I might point out that this subcommittee in 1977 held hearings on the question of passenger information, briefing and the role of flight attendants in that regard. Some improvements were made. But you are absolutely correct.

Let me tell you my own experience. I have observed cabin attendant training sessions. And when the crew was given training with respect to evacuation procedures, the use of the slide, getting out of the mockup of the aircraft, that with the exception of a few of the trainees who were designated to operate the slide, the rest of the people in training were simply acting as passengers and never even as a flight attendant had hands-on experience in operating the slide or handling the evacuation themselves. They were just participants and passengers.

I asked myself when I was watching that particular training session just how much did these flight attendants, who never had any hands-on training, how much did they actually know about carrying out that evacuation themselves if the situation arose?

So the whole question of passenger information is a major concern. As you say, sometimes you get a flight attendant who will really get the message across and get everybody's attention. But usually it is presented almost as a monotone recitation of something they have to do too many times.

Does the Safety Board monitor the required evacuation demonstrations when an aircraft is being certified by FAA?

Mr. BURNETT. No, sir, we do not routinely do that. I suppose we have witnessed some of them.

Do you have further comment?

Mr. McCormick. We have, at the invitation of various manufacturers, visited Boeing, Douglas, et cetera, and witnessed one or more of these tests. We don't do it on a routine basis, no.

Mr. Levitas. Have you ever witnessed one of those, Mr. McCormick?

Mr. McCormick. No, sir; I haven't. I have taken part in one or two at a demonstration with an air carrier.

Mr. Levitas. Have you?

Mr. Kapustin. No, sir. I have witnessed one as a trainee on the L-1011. That is all.

Mr. Levitas. The reason I ask is that I get information from a number of sources that these certification demonstrations do not replicate real world situations.

You don't have the baggage in the aisles. They get the number of passengers required to meet the demonstration requirements frequently by having people sit on each other's laps. You just have almost an artificial demonstration rather than a real world demonstration.

I was wondering if the Safety Board has any concern about that.

Mr. Burnett. Yes; we are concerned about that. We have heard the same reports.

Mr. Levitas. Are you aware that FAA recently changed the requirements for air carriers on the subject of passenger evacuation from a full-scale demonstration to what is referred to as a minievacuation?

Mr. McCormick. The FAA has established the 90-second limit to evacuate an air carrier airplane; the 90 seconds includes 10 seconds for the flight attendant to leave the seat, to open the door, and for the slide to deploy and to inflate.

We are aware of research which the FAA has been conducting for several years in using a computer math model to simulate the actual evacuation of people from an airplane.

One of the arguments against a full-scale demonstration is the number of injuries to the people who are used in the demonstration. It is well known within the industry itself there are a number of injuries with any of these tests.

Mr. Levitas. What troubles me is that the minievacuation procedures which FAA has now authorized under certain circumstances does not even require evacuation by the passengers from the aircraft. It is just a demonstration of the work and role of the flight attendant.

Mr. McCormick. That the flight attendant can leave the seat, get to the door, open the door and simulate opening the slide in so many seconds.

As a result of several accidents, we have made recommendations to FAA to require the hands-on training for the flight attendants. As a result of our recommendations, the airlines now have full size simulators in most training bases where the flight attendants now can open the door, simulate the feel of that door, how heavy it is in the wind or if the aircraft is tipped to one side.

Mr. Levitas. You have the title of senior human factors engineer?

Mr. McCormick. Yes, sir.

Mr. LEVITAS. In an evacuation, the human dimension is as significant, maybe even more significant than the mechanical dimension.

A flight attendant who hasn't had the experience of trying to get people off a plane, in my judgment, doesn't have the understanding of what is involved in an evacuation. It is a hell of a lot more than turning a handle, opening a door, and deploying a slide. It is motivating people, giving them information, and getting them to respond. So this is an area of great concern to me.

I was wondering if the Safety Board had any interest in reviewing those procedures to see whether or not there is adequate certification in these demonstrations.

Mr. BURNETT. Yes, sir, Mr. Chairman, we do have that interest.

In fact, we are attempting to expand our human factors and human performance staff in order to be able to give greater attention to these types of issues which we think are very crucial. We have had several accidents and incidents recently which indicate how important it is.

One thing I might mention. There are press reports that the airline industry is going to increase the density of passenger seats in the wide-bodied aircraft. It seems to me they are dense enough already. But the only check there is on that, as far as I know, is the evacuation requirement; that you have to be able to evacuate the occupants within the prescribed period.

If that requirement because of the way, the method of establishing whether or not it can be done, is not effective, then we have no check on how many sardines they are going to cram into the can.

Mr. LEVITAS. Yes. And, of course, you have got the problem of narrowing the space not only between seats but also at the point of the exit door.

Mr. BURNETT. That is correct.

Mr. LEVITAS. And all the other variables. For example, it is one thing to have a vigorous young man like Congressman Molinari sitting in that seat next to the exit that has to be opened and pushed out, pulled in, whatever they do, and having a 78-year-old grandmother sitting there right next to that exit itself. These are all factors which contribute to the chances of an evacuation being successful or not.

Let me get back to the minievacuation. It is my understanding that one of the exemptions provided by the minievacuation is that where a new carrier—that is one that has never operated before and now is just beginning to operate with that particular aircraft—is not required to do a full scale evacuation demonstration but can simply rely upon a demonstration that had been done by another carrier of that same equipment.

Is that your understanding?

Mr. MCCORMICK. Yes, sir, it is, especially so with a carrier flying one type of equipment, another flying a second type and one of those two carriers deciding to increase the density of the seats. These minievacuations are a very small type segment.

Mr. LEVITAS. What do you think about that, Mr. McCormick?

Mr. MCCORMICK. I don't have much faith in it.

Mr. LEVITAS. What about a carrier who has been operating 737's and then buys a 747 that it has never operated before?

Mr. McCormick. I expect he would have to go through some sort of evacuation test.

Mr. Levitas. I hate to inform you that is not required. Under the minievacuation procedures, that is not only a theoretical possible, we already have an example of one carrier where that has actually occurred.

They were operating the narrow bodied, I think, 737. And because of a new route structure, aquired a 747. They relied upon the certification by the previous owner of that aircraft, and then performed the minievacuation, never having done a full-scale evacuation.

Does that sound to you like a good procedure?

Mr. McCormick. No, sir, it does not.

Mr. Levitas. Give you much confidence?

Mr. McCormick. No, sir.

Mr. Levitas. Does it give you any confidence?

I believe that is all the questions I have got. Let me just add one comment, Mr. Burnett.

There was some conversation between you and I believe Ms. Ferraro on the question of, or one of the members of the committee, on the question, to what extent does the industry influence some of the decisions or reluctance of FAA to proceed further?

I think the previous record of testimony before the subcommittee demonstrates that it exists, and effectively exists. Indeed, there is testimony already on the record that the SAFER Committee was an idea that had its genesis in the upper echelons of airframe manufacturers and other industry interests as a means of avoiding the implementation of proposed rulemaking that was pending at that time.

I think the record is pretty clear what has been the result. They were quite effective. They got their SAFER Committee and got no regulations.

Mr. Burnett. Yes. I believe in some areas they were regulations that could have been adopted, and we have named some of them but I think the work that the SAFER Committee did was valuable.

But unfortunately, to some extent it was used as an excuse for not going forward with things that could have been done.

Mr. Levitas. Mr. Molinari.

Mr. Molinari. We heard before some reference made to technology available today. I have been interested in studies that were conducted by NASA, I think the correct term is solimide polyimide foam, as opposed to polyurethane, which is what we are using today in my understanding on most planes.

When we look at the comparison of the properties of what we are using today as opposed to that which was tested by NASA in a 737 fuselage, we come up with some dramatic comparisons.

Hydrogen cyanide, with polyurethane, 165 parts per million after 2 minutes of fire, as opposed with this substances 6 parts per million after 7 minutes of exposure. Carbon monoxide, existing substance is 3,209 parts per minute after 1 minute. With this, 249 parts per million after 5 minutes' exposure.

Smoke obscuration, 100 percent with what is in there today after 1 minute of exposure. With this substance, none. Absolutely none.

Weight loss, 11 percent with this after exposure as opposed to 83 percent, for polyurethane which is I guess as close as you can get to ashes.

The question that I have is, After this comparison in the testing done by NASA, since it appears to me that we do have a viable substance here that could be used, the results by comparison are dramatic to that which is being used today, why is this substance not being considered by NTSB?

Mr. **McCormick**. I am not familiar with that particular material even though we do have contacts with NASA. I would suspect, however, that some of these new exotic materials, do not have the wearability that the present seat cushion does.

That was one reason for the fire block technology. The new exotic foams used in cushions may not last for 2 or 3 years as some of the present materials do.

Mr. **Burnett**. Congressman, we will be taking testimony on that issue at our hearings which will convene on the 15th of August.

There have been various materials proposed. We accept that weight is always a consideration, and there has to be consideration for wearability and comfort. However, we think that the FAA has not been as forthcoming as it could be with regulations to implement this sort of thing.

Mr. **Molinari**. I have the entire specifications on the back of this which compares virtually every quality you are looking for. Wearability and every other one, compares indeed very favorably.

I tell you, I am just shocked to find out that you are not even aware that that exists. I can't help but think to myself, why is it that if my staff in consulting with NASA was able to come up with this information, that you people invested with the responsibility of making safety recommendations, don't have a better dialog with NASA so you are aware of it. This is being used in some of our space shuttles.

Mr. **Burnett**. We do have a very close dialog with NASA and are aware of many of the materials they are testing. Some of them we are not ready to endorse or recommend at this point.

We will furnish our position on any materials that may now be subject to consideration in the course of our investigation of this accident.

Mr. **Molinari**. Well, I have read in the newspapers that talk about some layer or shield to prevent the polyurethane from releasing its dread toxic contents on the conditions such as in the plane at Cincinnati. Yet just from a little investigation from our own staff members, we come up with this material.

We wonder. It has been tested thoroughly. We have got complete review. You folks don't even know about it. I have got to wonder what is happening out there.

Mr. **McCormick**. I don't personally have that material. However, we have reports on materials such as polyimide that have been tested at NASA Langley, NASA Ames, National Bureau of Standards, Notre Dame, Harvard, et cetera, since and prior to the SAFER Committee, and have been found to be not acceptable for use in air carrier airplanes for several reasons. I don't want to give the impression that we are ignorant of the materials and testing going on.

Mr. Molinari. This is in use by NASA now. They have it in their spacecraft. You figure the one thing we would know is the material being used in their vehicles, they have been tested and retested time and time again. Here is one that they have and I am listening to a panel telling me that they are not familiar with it.

Mr. Burnett. We have testified previously about that. I get the sense from discussions with people at NASA that they feel that the fire-blocking material is the best technology in use now on aircraft. You have different considerations than you do on the NASA spaceships. The durability factor and the comfort factor and the weight factors perhaps are somewhat different. It is our understanding, at least mine, at this point that NASA is in agreement that the fire-blocking program that the FAA is going forward with is the superior one and they have been involved in that development and that testing.

Mr. Molinari. I can't accept that. If you are talking about the best recommendation is to block the substances and the toxics as they come out of the burning cushions, aren't you better off with something that is going to emit less and still block? You are looking for the best state of the art. If you start off with a product with qualities that are much safer, and lightweight, every question that you have mentioned here today as to maybe there is a problem with it. When I look at the specifications here I find that it compares very favorably.

Mr. McCormick. One of the spinoffs from the technology of fire-blocking is the requirement that airplane seat cushions must be floatable. This is something that does not enter into the fire aspect at all. The blocking material adds significantly to the ability of a seat cushion to float. I am not sure that that material without fire-blocking would be able to float or support someone in the water for any extended period of time. We have been informed by NASA and FAA that there is no cushion material now available which behaves in a dynamic fire scenario as well as the fire blocking material does.

Mr. Burnett. From my conversations with NASA, their experts have indicated to me they feel that the fire-blocking technology is the best one to proceed with now. They see down the road that in fact they will be able to add to that a much better foam material than they now have and that of course will be an additional benefit. One of the problems that we have had with the FAA over the years is that they are always waiting for the next generation of technology. They are not willing to implement what is available now because they see something very attractive down the road.

We don't want to discourage them, when they have a very great development, such as the fire-blocking material which is acceptable from the standpoint of weight expense and durability. We don't want to discourage them to use that waiting for something assumed to be coming down the road.

Mr. Molinari. I suspect you have put your finger on the problem. My interpretation, a wild guess, frankly, is the cost factor. When you have so many aircraft in use, you could probably install some type of fire-blocking material at a somewhat minimum cost. I don't know what it would cost to develop this technology further so you could make cushions that could be put in use. But I have the same problem that other members of the subcommittee raised, that as we look at a new generation of aircraft that will be developed and sold, why are we not looking closer at this? I would ask you in conclusion if you wouldn't do me a favor and study this material and report back to the subcommittee on your analysis as to whether it is feasible and check all the qualities you talked about, durability. Its ability to float, you know, is a whole other question.

I don't want to get into that, but there have been some serious questions raised about the floating abilities and qualities of cushions that we have today. I have serious questions in my own mind as to whether they aren't a total failure, the material that we are using today. I think some of them are really a hoax on the public. We have had examples, I believe, where people have taken out their seats and used them as a floating device to save peoples' lives and lives have been lost through drowning.

I don't want to get into that. I think that it has been a good hearing. I think it has been productive. I appreciate the testimony that you have given and your ability and expertise to cooperate with us, but I said to the chairman before, and I think that I would just like to make that a matter of record, that we have heard these stories so many times that it now puts us in a very difficult position, one where we cannot as a subcommittee dealing directly with the subcommittee matter sit back any longer and allow this to continue for years and years and years getting the same kinds of answers.

I am not suggesting the Safety Board itself is at fault. I think the primary responsibility and the fault lies with FAA. I don't know why over the years we can't develop a better working relationship or you folks can't. Maybe it is a natural adversarial position you are put in by virtue of your oversight functions. It seems there is a lot lacking and I am grateful to the chairman for scheduling these hearings. I look forward to working with you in the future. Thank you.

Mr. **Levitas**. Thank you very much, Mr. Molinari.

Mr. Burnett, in the last 2 years, how many fatalities have there been in aviation accidents?

Mr. **Burnett**. In all aviation accidents?

Mr. **Levitas**. Commercial U.S. air carriers.

Mr. **Burnett**. In the last 2 years, in all types of air carrier accidents?

Mr. **Levitas**. Yes. U.S. air carriers.

Mr. **Burnett**. Excuse me. Did you say accidents?

Mr. **Levitas**. How many fatalities have there been through all causes in U.S. air carrier accidents in 1982 and 1983?

Mr. **Burnett**. 235 and 27 is 262.

Mr. **Levitas**. 262. And how many fatalities have occurred in accidents where there was fire?

Mr. **Burnett**. In the last 2 years, the only one would be the most recent, the Air Canada.

Mr. **Levitas**. According to the chart on the next-to-the-last page of your testimony, it appears there were 154 in 1982 and 26 in 1983. Is that correct? I am looking at the—the chart on the next-to-the-last page of your testimony.

Mr. **Burnett**. Yes; those are the——

Mr. LEVITAS. Those are fatalities——

Mr. BURNETT [continuing]. Total number of fatalities in accidents with fire. Frankly, Mr. Chairman, they don't all come to my mind right now.

Mr. LEVITAS. There is a total of 7 accidents that are indicated, 4 in 1982 with 154 deaths, 3 in 1983 with 26 deaths. My point is, Mr. Burnett, that two-thirds of all people who perished in a U.S. air carrier accident in the last 2 years perished in an accident where there was fire, which seems to me to make this matter not only one of grave concern for the traveling public, but should take on the highest priority.

Mr. BURNETT. Mr. Chairman, we need to be a little careful with that because some of those were nonsurvivable accidents anyway and cannot be attributed to fire. I would have to analyze those accident by accident.

Mr. LEVITAS. I was going to ask you that. I notice here since 1969, when your chart begins, there are 419 deaths resulting in accidents where there is a postcrash fire.

Mr. BURNETT. That is correct.

Mr. LEVITAS. And if you add to that the number of fatalities in the Air Canada accident, you get a rather significant number of people who have died in survivable accidents.

Mr. BURNETT. Mr. Chairman, if you look at 1965, the accident that—out in Utah, through the 1983 accident we just had, we have a total of 533 deaths from fire in just U.S. carriers. We had two accidents, one at Tenerife in which there were 157 deaths that we could not determine the cause of death, but two-thirds of the deaths that were determined on that accident were from the effects of fire. Then we had the Mexico City accident in which there were 70 deaths, none of which were officially designated as to cause of death because the report that came forward was from a foreign government.

So we could add perhaps 227 people to that, which would bring it up to about 750 or so. Then there were three accidents overseas on U.S.-manufactured aircraft, those being the 124 that died in the accident in France, 301 in Saudi Arabia, and then the Spantex accident in which fire was involved. So you get that figure up past 1,000.

The frightening thing, though, is that one accident can double the figure of 419, and that is what we are concerned about.

Mr. LEVITAS. Well, we are, too, and as these hearings continue, we are going to get some answers and we are going to get some action.

Tomorrow we will be hearing, we expect, from some of the people who survived the Air Canada accident to give us an insight into what occurred firsthand. We also will be hearing from the Association of Flight Attendants, who obviously have a very important role to play in this entire matter, as well as the International Association of Firefighters. And I think that a good deal of what you and Mr. Molinari and others have testified today will be made dramatically clear by some of the testimony I expect we will be receiving tomorrow.

Mr. MOLINARI. Mr. Chairman, if I could impose upon you——

Mr. LEVITAS. Yes.

Mr. **Molinari.** I have just been handed by staff a rather important document I think, and this document is a press release that was issued by NASA dated December 11, 1980. The headline of the press release reads "NASA Announces New Fire-Resistant Material for Aircraft." It goes on to describe the material that I referred to before.

One paragraph that really has to hit you between the eyes—"The new flame-resistant material named polyimide resilient foam could further reduce inflight fire risks and lengthen the time required for evacuation from 2 to 5 minutes for a survivable crash complicated by an external fuel fire." It goes on to describe the qualities. One short paragraph, "The foam is not only safer, say NASA safety experts, but also provides an estimated 50 percent weight savings, thereby improving aircraft energy efficiency." We are now talking about something that was publicly announced by NASA 2½ years ago, and yet today, and in fairness, at the conclusion of the statement, they said the technological utilization office at NASA had recommended the materials be made available to the public, particularly the aircraft industry.

They said that the industry chose not to adopt them because they claimed that the materials lacked durability, were not commercially available and cost too much to produce. From what our staff has told me, we have serious questions about those objections that they have. But here we have a material that I was shocked to learn that this information has been public by a press release issued by NASA 2½ years ago, and here we are—I have to get back to Mr. Helms, when he was here only 1 month or so ago, and we asked him the question whether there weren't other materials out there that could have been utilized to save these people, remembering that the reports indicated that some of the lives were saved by a mere 1 or 2 seconds and some of the lives were lost by the same margin of time.

I suggest that somebody is not doing their homework.

Mr. **Burnett.** We have testified before this committee and others about that particular material. However, I have no basis right now to dispute that the course that the FAA is following with their fireblocking material is the best course given the information that they have available to them. The question of whether or not something could have been done before now is one that I think is very much open.

Mr. **Molinari.** Well, I will close on that note, Mr. Chairman, but I am still going to look forward with great anticipation to your analysis of this material.

Mr. **Levitas.** We will be looking forward to receiving that, Mr. Burnett. I might add that the press release which Mr. Molinari just referred to and the disclosure by NASA at that time in 1980 was in direct response to hearings conducted by this subcommittee, and again, we are back where we started, it seems. But we won't be, I am convinced of that, in the days ahead.

I want to thank you and your colleagues for your participation. Your testimony has been extremely helpful, and I believe lays the backdrop against which the hearings over the next few days this week and in the future will provide us with the necessary information to do what needs to be done to finally get some action in protecting the lives of the traveling public.

Thank you.

Mr. Burnett. I thank the committee, Mr. Chairman.

Mr. Levitas. There being no further business, the subcommittee stands in recess until 10 a.m. tomorrow morning.

[Whereupon, at 12:55 p.m., the subcommittee recessed, to reconvene at 10 a.m., Wednesday, July 13, 1983.]

AVIATION SAFETY

(Aircraft Passenger Survivability and Cabin Safety)

WEDNESDAY, JULY 13, 1983

House of Representatives,
Subcommittee on Investigations and Oversight,
Committee on Public Works and Transportation,
Washington, DC.

The subcommittee met, pursuant to call, at 10:05 a.m., in room 2167, Rayburn House Office Building, Hon. Elliott H. Levitas (chairman of the subcommittee) presiding.

Mr. Levitas. The subcommittee will please come to order.

This morning we resume hearings on the matter of aircraft passenger survivability. And we have completed the first phase of these hearings yesterday, having heard from the National Transportation Safety Board.

This morning the first witness is Mr. Roy Grubbs from Dallas, TX, who was a passenger on the Air Canada DC-9. Mr. Grubbs is an electrical and mechanical engineer, a frequent flier, and has had extensive working experience with NASA on Skylab, Apollo, and Viking, in addition to other experience in that area. And the subcommittee feels that it is of vital importance to our understanding and to this record, in order to place into context what needs to be done in the future, to get a clear understanding of what actually occurred in the Air Canada accident, within that aircraft, from a firsthand witness because in that way, and only in that way, do we believe that we can get an understanding of what we need to do for the future.

I know for many of the people, everybody in that disaster, it was a traumatic experience, and one that has caused a great deal of personal difficulty. For that reason, Mr. Grubbs, we are extremely grateful for your willingness to be with us this morning and share with us from your viewpoint just exactly what did occur and your other observations. So on behalf of the subcommittee I want to thank you for being here. And I wonder if you might start out just by giving us a little of your own personal background in terms of your flying experience as a passenger.

And I made reference to your background as an electrical and mechanical engineer, just a little background of that so we might have some understanding. Then we will get into some further questions. If you want to start off by saying anything else on your own, feel free to do so.

TESTIMONY OF ROY GRUBBS, DALLAS, TX

Mr. GRUBBS. Well, good morning, ladies and gentlemen. It is a very extreme pleasure to have the opportunity to visit with you today, especially after the experience that 18 of us, plus the 5 crew, did experience. One of the main backgrounds of my personal experience was starting out many years ago as a mechanical engineer at LTV. Had the extreme privilege of working on the first Apollo spacecraft on the temperature controller as well as a joint program with one of the backpacks that the astronauts finally got to walk on the Moon with. From there to Navy programs, working with the Navy Department here, at Tracor in Austin, TX, on a decompression computer for the scuba divers—sort of classified information. From there to the Skylab, that the astronauts orbited 58 days on their last venture into space on the Skylab.

I had the privilege of working four or five medical boxes that they used for urinalysis, respiratory analysis, heart monitors, and other pieces of equipment that I will not disclose at this time. The part of another program which is now a tremendous interest to the United States and the rest of the world was a little bit of work on the space shuttle, that at that time I was employed by Martin Marietta in Waterton, CO. From that time, I then went to work finishing my programs. I went to work on my present program as a mechanical engineer, field engineer and also a director of marketing and sales for Stone Vinney Corp. out of Dallas, TX, which we at the present time are working very, very strongly into transportation, the transit buses, through UMTA, through all of the bus coach manufacturers throughout the United States and Canada, and also over in Europe. So I am very familiar with the flame retardant-type materials that are used in transit buses.

And a transit bus, anything that moves people, you have to have the safety. In an aircraft it is not any different.

Mr. LEVITAS. Thank you very much. Could you also just describe briefly for the record, are you a frequent flier? Do you fly as a passenger on air carriers?

Mr. GRUBBS. Yes, I do, sir. I drive quite a bit. In fact, I have got a new car right now. It is 14 months old and I have got 70,000 miles on it. But I also fly a tremendous amount in Europe, all over the United States and Canada.

Mr. LEVITAS. On the occasion of your flight on the Air Canada DC-9, where were you seated in the aircraft?

Mr. GRUBBS. I was assigned seat 12B on the aircraft, which is an aisle seat. I guess it is just my superstition, if you call it superstition, I always sit on an aisle seat regardless of where I fly. I am a smoker, and I always get in the smoking section on an aisle seat, which was 12B.

Mr. LEVITAS. I always try to sit on the aisle myself, Mr. Grubbs. But not because of superstition. I just like to be able to get to the lavatory easily. And was the DC-9 filled? Was it half filled? What was the density of the passengers in the aircraft?

Mr. GRUBBS. My first flight that I was scheduled on was 8 o'clock that morning of the second of the month. And I called General Motors. I was on my way to General Motors in Outer Montreal to assist them in training their manufacturing people to put our controls on for a customer in the States, and also work with their engineering group. And I called them, and my flight would have left at 8 o'clock that morning, but I wouldn't have arrived into Montreal until about 2:30 that afternoon, and it wouldn't give time.

So I called my travel agency that does all of my flight arrangements for me, and told them to give me the later afternoon flight, and I would be there at 11 o'clock the next morning. They changed me to the Air Canada flight, I think the flight number is 797, if I'm not mistaken. We had a very, very nice flight.

When we took off, I have made that flight many times going to Toronto, ON, and also into Montreal on Air Canada. Many times. So it is nothing to be concerned about. So I took the later flight that afternoon.

Mr. Levitas. First of all, let me make sure I get the answer to that question, though, because it is of some significance. Was the plane full, or half full, or a third full?

Mr. Grubbs. We had 41 passengers aboard the flight. It was a very—on the DC-9, it has 108 capacity. There was only 41 passengers aboard, and only 5 crew members—the captain, the pilot, copilot, the steward, and 2 stewardesses.

So when we took off, sir, everybody was pretty much in the front of the aircraft. As we got above cruising speed, then people started moving around a little bit. In that particular aircraft there, there was three to the right side of the plane, three seats, and two on the other, they just kind of spread out a little.

Mr. Levitas. Now, before you took off for—in your taxiing out, did the flight attendants give the normal routine safety instructions about the oxygen mask and seatbelts and such things?

Mr. Grubbs. Yes, they did, sir.

Mr. Levitas. Was it similar and standard to the type of instructions you had previously received on other flights?

Mr. Grubbs. Yes.

Mr. Levitas. Was there a meal or beverage service afforded you?

Mr. Grubbs. This particular flight, of course, would have an evening meal flight. And there was beverages served. As a matter of fact, my only second time after the accident, and I still am kind of uptight, so I had me a good old bourbon and water. But we had a very, very nice evening meal, and the accident occurred after the evening meal trays had been picked up.

Mr. Levitas. Was there a passenger sitting next to you, or on the aisle seat opposite you?

Mr. Grubbs. Sitting in 12B, I had no one to my left, setting on the left-hand side of the aircraft at the wing. To my immediate right, there was, I cannot recall their name, it might have been Mr. and Mrs. Moseley who was sitting directly across. He was at the window seat and she was in the aisle seat. The middle seat was vacant.

Mr. Levitas. When and how did you learn that there was smoke coming from the lavatory?

Mr. Grubbs. My first detection was when I saw the captain, or the copilot and the steward come back with a fire extinguisher. And I made the statement many, many times that there was no noise. You do not hear smoke, you only see it. When I saw them coming back, I stood up. I looked to my immediate right, which was on the rear of the aircraft. Smoke was coming out of the return air vent above the overhead luggage rack.

There was statements that it was coming out of the bathroom. After looking at everything and getting the information from the FAA, there was no bathroom on that side of the aircraft. It was a storage closet. The smoke was coming out. Was a light gray smoke. It began to have a very heavy toxic to it. Then as if you would light a very long fuse on a firecracker, it started boiling out very, very rapidly, and very thick and very dark and very heavy toxic fumes.

I—one of the stewards said, "Let's open the air vents." I stood up and I was assisting in trying to open air vents to maybe try to get some circulation in the plane. That did not help. It got continuously worse. And I walked up immediately then, followed the captain—I mean the copilot and the steward and I walked up to the front of the aircraft and was standing at the cockpit door. And that is where I stayed during the rest of the flight.

Mr. LEVITAS. So until the flight crew, two of the flight crew came past you with the fire extinguisher, you had neither seen nor smelled nor experienced any of the smoke?

Mr. GRUBBS. There was so many statements of people that were saying things about what happened. They said it started in the bathroom by a cigarette. There was sort of a letter that I saw this morning on television about, you know, things that had happened. I just can't believe it.

There was nothing that a cigarette could not cause a—a situation of that nature. Of coming off of the floor of the aircraft in a wastebasket. It was an electrical fire. I made that statement many, many times. And the pilot also said that one of the circuit breakers, and it—one of the circuit breakers that had to do with the flushing mechanism of the commode that is in there, one circuit breaker, that had popped and he could not reset it.

To me, with the knowledge that I think that I have in some of the other programs that I worked with, it had to be an electrical short which caused the fire to occur.

Mr. LEVITAS. But you had not personally smelled or seen the smoke before the two flight crew people went past you?

Mr. GRUBBS. You could smell a difference, OK? But it just wasn't that bad when it first started. Like I say, it was a very light gray smoke. But it began to have a toxic smell to it. And I guess my reaction was, I stood up. I looked at that area, and then it started very rapidly. It subsided for a second, and then it started really just going down the side of the right-hand side of the aircraft at the return air vent. That is the only place the smoke was coming out.

Mr. LEVITAS. So the smoke you saw when you began to notice was moving up the aircraft on the rear from the right side?

Mr. GRUBBS. From the rear on the right-hand side. It could have been moving, sir, to the left of the aircraft but I only looked in the direction of the smoke that I saw. One statement that I can say, that there was no panic aboard that plane whatsoever. There was only one announcement made, to the best of my ability, when the smoke first started appearing.

The announcement came over the intercom saying would everybody please move to the front of the aircraft. People did move to the front of the aircraft. And put 41 people above, you know, row

12, forward. And I walked up then and did what I did by standing there at the front. And then the cockpit door was open.

Mr. LEVITAS. The cockpit door was open when you were——

Mr. GRUBBS. The cockpit door was open, and I saw—I could hear the communication of the ground air traffic controller that we were in the vicinity of Indianapolis and that they would give clearance for emergency landing at the Cincinnati International Airport. So I did hear that.

I was standing there and heard the conversation. As far as any other intercom announcements is concerned, I did not hear it. Or if I did, I don't remember it. But it was a very, very quiet, no panic situation on the plane. I felt like personally, also, that if there had been panic on the plane, that either two things could have happened. Either more of us would have got off, or less would have got off because we only had a few seconds. By the time we landed, got the emergency doors open and got off the plane, it was just a matter of a few seconds and that plane was totally enflamed due to the outside oxygen.

Mr. LEVITAS. The one announcement that you remember, emergency procedure announcement, do you know who made that announcement? Was it one of the female flight attendants, or was it the captain or the male steward?

Mr. GRUBBS. Sir, it was a voice. If it was a steward, I didn't pay any attention because I was up moving, trying to open the air vents up at that time. And I fly so many, many times that I just didn't pay any attention to it. People was moving.

There was two ladies on the back, on the next row behind on my right-hand side. I know that they definitely moved to the front of the aircraft. The one lady who after I had got off the chute, she dove down the chute head first and I caught her and picked her up. And this Connie Kersh, who lives in Texas, she came down. I picked her up. And then one gentleman came down. I assisted him, and nobody else was coming off the plane.

But as far as announcements are concerned, I didn't hear anything other than the very brief voices that I heard as far as the air traffic controller and the pilot about the emergency landing.

Mr. LEVITAS. Were you actually standing up as the plane was making its approach into the Cincinnati Airport?

Mr. GRUBBS. Yes; I was.

Mr. LEVITAS. Were you standing when the plane landed?

Mr. GRUBBS. If I was standing, I was not bruised other than a chest problem that I thought I was having because of some heart problems I had last October a year ago. And I did go to the—to my heart surgeon, my heart specialist. And my rib cage on my left side, my muscles and some tissue was pulled loose from my ribs. So if I got hit or something, I don't remember it at the time.

Mr. LEVITAS. By the time the plane touched down on the runway at Cincinnati International Airport, would you describe how thick the smoke was in the cabin at that point?

Mr. GRUBBS. If you would take and walk into your closet in your bedroom and close the door behind you and seal every bit of daylight from getting into there, that is how dark it was. You could not see your hand in front of your face. The pilot, by looking into the cockpit when they first opened the door—now, who opened the door, I don't know. It could have been one of the attendants. It could have been the steward, or one of the stewardesses.

But they was in no better shape than what we was. As a matter of fact, I talked to the captain after we landed. When he come out, we backed away from the plane and he said, let's make a head count. And I counted 18, he counted 18, and the 5 crew. And we knew that nobody else was coming off the plane. We only had just a few seconds, and there is not enough praise in a lifetime to praise how that gentleman did it.

Mr. LEVITAS. Mr. Molinari.

Mr. MOLINARI. I just would like to expand, if I could, Mr. Grubbs, with you on the question of the cockpit door, because we had some testimony indicating that the only access that smoke would have, testimony yesterday was, a missing panel at the bottom of the door. Now we are hearing that the cockpit door was open. Can you give us some idea as to when that door was opened in relation to the landing?

Mr. GRUBBS. Trying to go by time it would be impossible.

Mr. MOLINARI. Was it opened while the plane was still in the air?

Mr. GRUBBS. Oh, yes, sir, very definitely. It was in, as we was making a descent from the—you know, from 31,000 feet down to, from Indianapolis, approximately Indianapolis to Cincinnati Airport, that door was open before I even got a wash rag.

Mr. MOLINARI. Did it remain open until the landing occurred.

Mr. GRUBBS. I cannot say, but I am quite sure it was. I am not going to say this. But it was opened, because if the door was closed you could not hear the communications between the pilot and the air traffic controller.

Mr. MOLINARI. Did you have a view of the pilot and copilot——

Mr. GRUBBS. I saw the copilot only. From where I was standing I only viewed to the copilot of the aircraft, and he did have on a breathing apparatus.

Mr. LEVITAS. Let me ask you this question. You were standing in the front of the aircraft near the cockpit door. And from what you describe, you must have been on the left side of the aircraft.

Mr. GRUBBS. I was on the left side of the aircraft.

Mr. LEVITAS. Now, where in relation to where you were standing was the nearest cabin attendant?

Mr. GRUBBS. I would say that the steward, OK, when we first walked up to the front of the aircraft, there is a small seat that is a spring-loaded seat that the flight attendants will always sit at during landing and takeoff. I sat there briefly. I had no seatbelt. And the flight attendant or the steward was sitting there. But that is where I ended up when I could not breathe.

I nearly lost my breath a couple of times. And whether it was one of the stewardesses that was trying to get washcloths to the passengers, I ended up with one. Whether I grabbed it or it was handed to me, I got water on it through the galley, and put it on my face and I was OK.

Mr. LEVITAS. I was going to ask you about that, and I am glad you mentioned it. We have heard the testimony about the cabin attendants passing out wash cloths or towels or something. Did they give you any instructions? Or did they say to you about getting it, or did you just do that on your own?

Mr. **Grubbs**. There was no instructions whatsoever that I could hear. There, again, there was no panic on the plane. Even afterwards, by talking with the FAA investigators, and I made the statement on this, that if there had been panic people would have been moving around trying to climb over one another, of this nature. Everybody was sitting. I don't think she could even got down the aisle personally, myself, to try to hand wash rags out.

The descent was very rapidly, was very quickly. Whether they got even out of the galley area, I don't know.

Mr. **Levitas**. So you don't have a recollection of the cabin attendant actually walking through passing out these towels?

Mr. **Grubbs**. No.

Mr. **Levitas**. When the plane came to a stop, who opened the door? I assume you went out through the entry door——

Mr. **Grubbs**. I went out through the left-hand side entry door, right.

Mr. **Levitas**. Who opened that door?

Mr. **Grubbs**. I cannot tell you because I could not see. Everybody was, like myself was, was trying to try to get a good breath of fresh air somewhere somehow. I felt people going past me. When I went off the aircraft, you know, jumped and went down the slide, then there was only three people that came off after me. That was the one lady from Canada, Connie Kersh, and one gentleman that I did not have the privilege of getting his name.

And that is all I remember of coming out. So either they went off the wing, the galley exit, which is the right-hand side of the aircraft, the door, due to the pictures that I saw, was not even burnt. The door that we went out of, the whole top of the door was burned.

Mr. **Levitas**. You went down a slide?

Mr. **Grubbs**. Down a slide, yes, sir.

Mr. **Levitas**. Was there a cabin attendant standing next to the door giving you instructions about "jump," "go," or anything of that sort?

Mr. **Grubbs**. You could hear a little bit saying just get off the airplane. Just get out. There was no instructions to say, you know, jump or anything. There was the slide, and we jumped to the ground.

Mr. **Levitas**. Did you have your shoes on?

Mr. **Grubbs**. Yes, sir, I did.

Mr. **Levitas**. I have one other question at this point, then I am sure other members of the committee may have some questions as well. Do you have any personal firsthand knowledge of where the passengers who didn't make it off the plane were in relationship to where you were at the time the plane landed?

Mr. **Grubbs**. The only thing, sir, that I definitely remember that I think the Moseleys was still maintained in their seat because all of us at the hospital was talking about the accident and about the experiences. And kind of got acquainted a little bit. And he told me personally that him and his wife went out the wing exit. And he opened the door, or was assisting in opening one of the wing exit doors. Whether on the right side of the plane or the left side I do not know.

The two people that I saw, you know, that had any type of, you know, conversation with during the flight, was, you know, was them. Mainly because they was going to Europe and I had just come back from a European trip. And as far as where they was located or how they was doing.

But I will make this statement. That the—when the investigators from FAA come in to visit me in my office, they told me they said, "Roy," said, "if you had been, stayed in your seat where you was assigned to I wouldn't be talking to you today." Also that he made the statement that even the pilots, the crews, the attendants goes through a very, very tremendous amount of training as far as prevention of this type of emergency landing, or crashes or anything like that, they also made the statement to me that there was also two pilots from the Air Force who perished in the plane that were still in their seatbelts.

Mr. LEVITAS. Mr. Grubbs, you talked about having difficulty breathing, a breath of air, putting the damp cloth over your nose. And I gather that this was the biggest concern that you were having at this point. Are you familiar because of your experience with the emergency breathing equipment hoods of the sort that there has been some discussion of?

Mr. GRUBBS. I saw a—briefly this morning. I have heard some of the things about it because of, you know, the problems that I have got involved with NASA on some of the programs that I have worked on. Several years ago, Scott Aviation, which is in Buffalo, NY, designs and manufactures breathing apparatus for the fire department, for several different, you know, programs that they do. Pretty well nationally known. And they was also the prime contractor on this Navy program that I was doing for underwater demolition.

So, yes, I am familiar with certain phases but not of the hoods or things of this nature that it might be new on the market. But since I have got out of the NASA, you know, end of it, military programs and working with the transit authorities and/or the oilfield application, no, sir, I am not that familiar with the new product.

Mr. LEVITAS. We have heard in the past from FAA witnesses at that table that one of the reasons they don't require these smoke hoods, fire hoods to be placed on airplanes is that people won't put them on. They wouldn't wear them. They wouldn't use them. Would you have used a smoke hood if one had been available to you?

Mr. GRUBBS. Yes; I would have because I wouldn't have worried about messing up my hair or anything like that. I am looking for my life. And getting the human nature of people, a lot of people say I wouldn't put that thing on if my life depended on it. But if their life depended on it, they would put it on. If it was available to me, yes, sir, very definitely I would have used it.

If it would, by any way saved the people that perished on the plane, we feel like very definitely, after the very heavy, high toxic, dense smoke, that the 23 people who perished on that aircraft that were still in their seatbelts, we felt like that, and I felt like that they had passed out before we even landed that aircraft. If that had not been the case, more of us would have got off.

Mr. LEVITAS. Thank you, Mr. Grubbs.

Mr. Molinari.

Mr. MOLINARI. First, Mr. Chairman, I would like to thank Mr. Grubbs very much for appearing here today. I had a conversation with him in the backroom earlier today. And it indicated the reason why he was here was to hopefully give us some information that could result in the saving of lives in the future. And I think that it certainly demonstrates some courage. And I can say there were some other survivors who were simply not up to coming before us to testify. I think we can all understand that.

Particularly with your background, I think we have a kind of rare opportunity here to find out from a survivor just what took place. Let me ask you this if I may. You indicated that when you were standing in the door, at some point in time the door was opened by someone. You don't know who it was. But you did feel some people brush by you? Was it your impression that somebody had been going out the door before you?

Mr. GRUBBS. Yes, it was, sir. How many, I don't know.

Mr. MOLINARI. OK.

Mr. GRUBBS. There was not a count, nobody I guess at this, in a lifetime, could tell you that person went out what exit. Only by their personal experience that they had to interviews or anything else. I can only tell you what I experienced at that location of the aircraft. How many went before me or I know that how many after I went off—got off of the ramp and was standing there, there was only three people that followed me out. So they went somewhere out of the 18 people.

I was told by the FAA, and there again it is nothing but hearsay, as their word talking against what I believe in, that the exit at the galley exit, only one person went out that exit and that was a flight attendant.

Mr. MOLINARI. That was on the opposite side of the plane?

Mr. GRUBBS. That was on the opposite side of the aircraft.

Mr. MOLINARI. So there was some unknown number that left before you, then you left, then three came down the chute after you.

Mr. GRUBBS. Three came down after me.

Mr. MOLINARI. Who was at the bottom of that chute to help assist the passengers as they were hitting the ground.

Mr. GRUBBS. I can't answer that question. I know I was there.

Mr. MOLINARI. Did anybody help you when you descended?

Mr. GRUBBS. No, sir.

Mr. MOLINARI. Did you help any of the people that came down the chute after you?

Mr. GRUBBS. I caught the first lady when she dove down from Canada. She dove down head first. She was coming down very rapidly. She injured her left or right shoulder, I am not sure now. But I picked her up, tried to catch her, picked her up. And then Ms. Kersh from DeSoto, she came down, she slid down, just jumped and came down. Picked her up. And then one gentleman come down and there was no more coming off the plane, and we backed away from the plane.

Mr. MOLINARI. There were no airport personnel there that you saw?

Mr. GRUBBS. If there was I didn't pay any attention to them. I guess I was more concerned about people or trying to help them, because I knew that I was on the ground and I was OK.

Mr. MOLINARI. You had mentioned when the smoke first started to come out that you began to smell toxic fumes?

Mr. GRUBBS. Yes, sir.

Mr. MOLINARI. How did you come to that observation? How did the fumes strike you?

Mr. GRUBBS. Anytime that if you have ever been around plastics burning or electrical wires burning, of that nature, that was the smell. At the first smell, was not that bad. But then it erupted and got very, very bad, where as like if you was to swallow a bottle of acid, the way it was burning your lungs, your throat, very, very hard to breathe.

Again, trying to inhale and exhale, I think with people aboard the plane where I was taking very short rapid breaths of inhaling or exhaling or very deep breaths, I cannot say. But the smoke and the toxic was very, very bad on that plane.

Mr. MOLINARI. Was there anytime when you felt like you were about to pass out from the fumes?

Mr. GRUBBS. Yes. I lost my breath or started to lose my breath a couple of times. And I, whether if I was holding my hand over my mouth until I got the wet washcloth, then I was OK.

Mr. MOLINARI. Now, I would like to ask you about that. Can you describe what happened when you put this wet washcloth over your face?

Mr. GRUBBS. Well, it just more or less like making a damper where that you could get a bit of moist air, whether the washcloth was acting as a filter, but it was wet. And it was more or less as, you know, a moisture that you could, you know, feel. So it did help tremendously.

Mr. MOLINARI. You did witness a difference in your ability to breathe?

Mr. GRUBBS. Yes, sir, I did.

Mr. MOLINARI. How long did you have that on your face before you exited the plane?

Mr. GRUBBS. Seconds.

Mr. MOLINARI. Seconds?

Mr. GRUBBS. We just didn't have that much time. If we would have been aboard that aircraft a few more seconds, I wouldn't be sitting here today talking to you. It was just that close.

Mr. MOLINARI. I understand.

Mr. GRUBBS. Either it would have been due to smoke inhalation, as I understand right now after some of the interviews and things that the captain himself was just about at the point that he was going. And how he got us on that ground nobody will ever know. But he was at the point himself, with the cockpit door open, he was in just as bad a shape as far as seeing is concerned, as far as breathing is concerned, even if he did have a breathing apparatus.

Mr. MOLINARI. The copilot went out the window we understand. Do you have any personal knowledge of that?

Mr. GRUBBS. I did not know that the copilot, until this morning, went out the window. I do know that the captain went out the cockpit window. Because his seat, and I talked to him after that and shook his hand after we got on the ground. But he said that his seat had been beginning to burn. And they turned the foam on him. He was really saturated. And I had, of course, the foam on my shirt. I only had my sport coat and everything was—was destroyed in the plane. So I had it on me from where I was standing. But as far as the copilot is concerned, I did not know which way he exited.

Mr. Molinari. Now, how did the pilot get out, then? You did see that pilot——

Mr. Grubbs. I did not see him get out.

Mr. Molinari. I see.

Mr. Grubbs. I was more interested about people coming off the plane. Whether he got out at what given time I don't know. But he did say that he exited out the side cockpit window.

Mr. Molinari. Would you have any idea how soon after the plane landed that the fire engines began to spray foam upon the plane?

Mr. Grubbs. Depending on my own observation that why, if they had already made clearances to shutdown the airport for an emergency landing, depending on where the plane landed, I cannot tell you that. I was only inside and could not see out. But it seemed like when I got off the plane that there was foam being applied. But under the circumstances, why would they run out of foam and set back and let the plane burn itself out until more foam arrived? I did not know this until—you know, I saw it on television. That they run out of foam. Whether it is a statement by the FAA, whether it is a statement by the fire department, I cannot say.

Mr. Molinari. Well, I can tell you we had testimony to that effect yesterday, that apparently the normal complement of foam was there but it was not enough to extinguish the fire. That is what we were told.

It might be a sensitive question, but did you hear anybody scream or yell at any point during the landing or after the landing?

Mr. Grubbs. My statement that I said awhile ago was that there was no panic——

Mr. Molinari. No panic, I understand that.

Mr. Grubbs [continuing]. Whatsoever. I do personally feel if there was any screaming or hollering or anything like that. Why there was not to my ability to hear what was going on, I do feel like that the smoke, the toxic, was so bad that the people who perished from that airplane, in that aircraft, had passed out before we landed, is why you did not hear that. It was that bad.

Mr. Molinari. Do you have any recollection of any words being spoken by anybody other than the announcement by one of the attendants?

Mr. Grubbs. No, sir. That was what was so very, very unusual about this situation. Whether people thought, well, we was on our way down, and everybody was going to get off the aircraft. It was—there is no way of knowing of how that accident. I personally felt like that when I got a washcloth on me, that I knew I was going to get off that plane. I just had that in my own mind, that I was going to get off that aircraft.

I guess that is maybe everybody's own personal opinion that they wasn't concerned about it. But when you are overtaken by smoke, by inhalation, as that nature, I think that is why there was no panic. That people panicked in their own way because they were still strapped in their seatbelts. If they was trying to struggle or trying to scream or trying to move as you see many, many cases of people in panic, it is hard to understand.

It is very, very difficult to understand the situation until you are in it. And you only tried to—at that time you know you are looking out after yourself. And I wasn't worried. To me, I could have been but I don't remember. But I knew I was going to get off.

Mr. MOLINARI. You were asked to go forward by this announcement that came over the loudspeaker.

Mr. GRUBBS. Yes; I was. Well, everybody was asked to move.

Mr. MOLINARI. Everybody? OK. Do you have any recollection, at that point, concerning the visibility in the plane?

Mr. GRUBBS. Yes; there was. This was when the smoke first started. There has been so many statements made, sir, about opening—calling an attendant back to check the bathroom doors. I love people. I love to be around people. And I do not even remember even somebody going back maybe to check the bathroom door.

We had just finished the evening meal, and everybody was kind of set back, relaxed, and having a very good flight. So I did not see that my personal self. If this happened, it happened. But I did not see this type of movement in the aircraft other than the attendants finishing picking up the evening meal trays until the smoke started and the only people that I saw move was the cocaptain, the copilot, and the stewardess come back with the fire extinguisher. The movement on the plane was very nil.

Mr. MOLINARI. I am not sure that I fully understand your last point. Are you saying that you didn't see anybody—there was a report that somebody was smoking on the plane. Did you see anybody smoking, walking down the aisle.

Mr. GRUBBS. No, sir; I did not.

Mr. MOLINARI. OK.

Mr. GRUBBS. People who travel as much as I travel, that you go by the rules and regulations that is set forth by the—by the attendants, that they ask you, you know, not to smoke while in the lavatory, do not smoke when you are out of your seats if you are a smoker. And I think people normally recognize that and abide by it. So, but I did not see anybody, no, sir.

Mr. MOLINARI. Did you have any occasion by chance to have visited the lavatory while you were airborne?

Mr. GRUBBS. No, sir; I did not.

Mr. MOLINARI. Now, when you did move to the front of the plane were you accompanied by other passengers as well?

Mr. GRUBBS. Like I made the statement awhile ago, that when I was back in the back trying to turn the air vents on, the captain, or the copilot, excuse me, and the attendant and myself walked forward. There was—everybody had already moved to the front of the aircraft. So there was no obstruction in the aisles or people standing or trying to move or I would have recognized it. I just walked straight up to the front of the aircraft.

Mr. MOLINARI. Let me just see if I can clear up in my own mind, then, what transpired. When they moved to the rear with the fire extinguisher, did you follow them?

Mr. **Grubbs.** I turned around. I stood up at 12B. I turned around and saw the direction of the smoke, which was on the right-hand side at the rear of the aircraft. And the steward or the copilot, I do not remember which, says let's open the air vents. And I started assisting them in opening the air vents.

Mr. **Molinari.** This is around 12B where you are?

Mr. **Grubbs.** 12B, behind me, because there was no gentleman in front of me, the rest of the aircraft was full from me forward. There could have been some at the rear but I didn't pay any attention to it. I was looking at the smoke, and what was going to happen.

Mr. **Molinari.** I take it the reason why you didn't move earlier to the front portion of the plane was because you were opening the vents, or attempting to open the vents?

Mr. **Grubbs.** Well, they had asked everybody to move to the front of the aircraft and there just wasn't many seats available that I could understand that I could see. I could see the people who moved that was behind me up to the front of the aircraft. And I guess that is why in my own nature of moving up, and even if I had to stand or set down on the floor to get away from that area.

Mr. **Molinari.** Did you notice anybody in any unusual position trying to escape the smoke, for example, laying on the floor or——

Mr. **Grubbs.** Well, you could not see, sir, you know, as far as the very heavy dense smoke. I don't guess you was paying any attention to that, that particular item or what people were doing. Even after the—according to the FAA investigators told me that there was only two or three people that was out of their seats. The rest of them was still in their seatbelts. So, no, I did not recognize any unusual movement.

Mr. **Molinari.** Now, the point at which you observed the smoke for the first time coming out of the vent, that was on the right rear was it?

Mr. **Grubbs.** Yes, sir. They were saying that it came from the bathroom. On the DC–9, as I was told, that plane had just gone through a remodification. As a matter of fact, the same aircraft was the one that dropped the tail cone several years ago. They had just redone some seats. They had removed row one of the seats and increased the galley, and also a coat closet. And at the rear of the aircraft the only restroom was on the left-hand side. The right-hand side was a storage closet and that is where the smoke came from.

Mr. **Molinari.** So that it is your belief then that the reports that the smoke started in the lavatory is not borne out by your own observation?

Mr. **Grubbs.** I don't see how it can when there was no lavatory there. If it got from the left-hand side through a lavatory all the way around to the right-hand side of the aircraft, I don't see how that could happen. It could have been the circuit breakers that was in the storage closet area or electrical area at the rear of the aircraft, but it was an electrical fire, yes.

Mr. **Molinari.** All right. I have one last question for now, Mr. Grubbs. Could you give me any rough estimate as to the time you first turned, observed the smoke, and how long it took before you couldn't see in front of you.

Mr. Grubbs. Five minutes.

Mr. Molinari. Five minutes. Thank you, Mr. Grubbs.

Mr. Levitas. Thank you, Mr. Molinari.

Dr. Rowland.

Mr. Rowland. Thank you very much, Mr. Chairman.

Mr. Grubbs, I certainly appreciate your being here. I know that that was a harrowing experience and one that only a person who had been involved in it could fully appreciate. I have a couple of questions I wanted to ask you. You are convinced that this was an electrical fire. You have fully established that to your own satisfaction that it was an electrical fire?

Mr. Grubbs. Yes, sir.

Mr. Rowland. The thought occurs to me that if there is a circuit breaker that should have tripped, it should have tripped before there was enough spark to cause a fire. From the perspective of your background as an electrical engineer, do you have any thoughts as to what may have taken place in that the circuit breaker didn't function properly to trip before a fire was started?

Mr. Grubbs. An electrical, as far as the circuit breaker is concerned, could be tripped by many, many things. Even overload or a short in the circuit that was cause for it to trip. The pilot made a statement which I believe is very, very true. That this circuit breaker has an indication up in the cockpit. That he has control of one panel in the aircraft. He said that the circuit breaker had popped and showed the white. On this particular type, many, many types of circuit breakers, depending on what the voltage, and you know what their amperage rating is of the particular electrical circuit that is involved with.

He said that it tripped, and he could not reset it.

Mr. Rowland. You mean he tried to reset it.

Mr. Grubbs. He tried to reset the circuit breaker and he could not reset it. And that could have caused maybe like a chain reaction of electrical spark that could have tripped everything. Maybe that is why, thinking about it here today, this morning, that maybe that is why there was not much of a communication. That if it had gone through an electrical system it could have also started burning the electrical wires for the communication system or the intercom system of that nature.

There again it has to be started by electrical because you could not even see the overhead lights, even if they had gone out, caused by the electrical short. It was so dark you wouldn't even see the overhead lights being on.

Mr. Rowland. Then I would need to ask someone else this question, but the pilot, or the person who tried to replace the circuit breaker from the position of being tripped, the thought occurs that that might not have been proper. And that within itself could have caused continuous spark that might have started a fire.

Mr. Grubbs. To me the way it looked from my observation of the way the smoke was coming out of the return vent, there again it reminds you of a fuse off of a firecracker. That it rolled down the right-hand side of the aircraft very rapidly, as if wires were burning with electrical insulation that is on some wires.

Some of those wires the insulation is very toxic. If you ever try to burn one and get it, you can see that it can be very toxic.

Mr. ROWLAND. Mr. Chairman, I will have to ask this question of someone else, but the thought does occur. Is it customary for people in charge to try to reset a circuit breaker while an aircraft is in the air after it has been tripped, rather than trying to find the cause. But I will have to ask that question of someone else.

Let me ask you another question. We learned yesterday that even though the fire started in the rear of the aircraft that the principle fire subsequently was in the front of the aircraft and this was due to flashover. Because as I understand it, accumulation of flammable gases accumulated in the front of the aircraft, and most everyone was in the front of the aircraft, you indicated because they had been told to move to that area.

I think you said there were two or three people that were not in their seats that did expire in the fire. I don't believe any of the rear exit doors were opened. So far as I can determine none were opened from looking at the film we had yesterday. The thought occurs as to whether or not if, in fact, someone had opened the rear exit doors at the time the aircraft had landed, whether it would be possible for people to get off. I know that is just conjecture but have you had any thoughts about that, or have you thought about that at all.

Mr. GRUBBS. No, sir; I have not. You know like I said only what I observed, that I did what I did to the front of the aircraft, and believe me that is the worst place for anybody to be, really, is the front of an aircraft. That is always where it hits first if you are going to crash or anything. As far as the rear exits is concerned on the DC-9, the very tail section was not opened. You have a stairs going down that normally you would exit sometimes if you cannot get up to the terminal, they will let you exit off of that or bring a portable exit for the front of the aircraft.

The wing exits, that is where people told me that, like the Moseleys, that did go out of the wing exit, whether there is only one exit or both sides of the aircraft, I do not know. All I know that one gentleman from Canada that was in the room next to me at the hospital said a friend of his, traveling companion, he crawled on the floor.

He was sitting right in front of me if I had been sitting in my seat. He crawled on the floor and he went out one side of the aircraft, he didn't say right or left, and his friend, traveling companion, went out the other side and they did not know until 10 to 15 minutes later if either one of them had survived.

Mr. ROWLAND. Do you know how long it may have been from the time you got off the aircraft until it actually caught fire on the front part? Do you have any idea what period of time that may have been?

Mr. GRUBBS. When I looked up, I was more concerned about that time of people coming off the plane. When I looked up, the flame had, quick as the oxygen, the doors was opened, whether it had been a wing section or whatever, that let the oxygen into the plane, ignited the flame, of my—to what I saw. It started at the rear and then it seemed like also at the center and at the front all at the same time. But it was not just a few seconds that flames were appearing. One kind of strange feeling to let you know this, that they did locate my briefcase. And my briefcase, I always carry my briefcase in the front seat on the floor at my feet. The bottom of that briefcase wasn't even burnt. The top of it had a tremendous amount of contamination, whether if it been survivors or whatever, I could not hardly stand to look at it, I got everything they—they wanted me to get everything out of the contents of my briefcase and they took it back with them. These were Air Canada personnel. But as far as the heat is concerned, everything was overhead. From the floor up. And the air—the investigator said that even the seat that I was sitting in was melted to the floor.

Mr. ROWLAND. Do you think that there was enough time then for there to have been any opportunity for anyone on the ground to have boarded that aircraft and helped people get off?

Mr. GRUBBS. If there had been people available and trained with the right type of flame retardant suits and everything, there possibly could have been. I had a call after John O'Hara called me last Sunday to ask me to visit with you all today, a gentleman who is the battalion chief for the Orange County Airport and he was quite concerned about the instance I was involved with, to show, would I support him in showing justification, cost justification for such problems, why did not they have people there trained to immediately go in that aircraft, because they go through flaming buildings and homes and everything else. Is there any difference between a plane and trying to save people?

Mr. ROWLAND. Thank you, Mr. Grubbs.

Mr. Chairman, there is a concern I have. Why did the pilot or whoever was in charge push the circuit breaker back on? Why wasn't there some exit from the rear of the plane? Why wasn't somebody on the ground helping to get the people off of this aircraft?

Perhaps I will have an opportunity to address these questions to someone else.

Thank you very much, Mr. Grubbs.

Mr. GRUBBS. Thank you, sir.

Mr. LEVITAS. Thank you, Dr. Rowland. There will be other witnesses coming before the subcommittee who will be able to address those questions.

Mr. Snyder.

Mr. SNYDER. Thank you, Mr. Chairman.

Mr. Grubbs, I want to express my appreciation for you being here and helping us to understand as best we can what did happen.

I just have a couple of questions, one along the lines that Dr. Rowland was asking you. Am I correct that the circuit breaker opens, or whatever you might want to call it?

Mr. GRUBBS. Trips.

Mr. SNYDER. Trips, OK, disengages, and that when you attempt to reset it, that for the time that you have got your finger on it or holding it over, whichever way it happens to work, that you do send another surge of current back to wherever the problem is?

Mr. GRUBBS. Yes; you do. In other words, a circuit breaker is not any different as a circuit breaker in your light panel in your home. If you get an overload of current, say you have got too many lights on in your house and you have got your microwave oven going and you have got your deep freeze going and whatever, and you trip the main circuit breaker switch, everything is shut off, and when you put that circuit breaker back on, then you regain current through the total system.

That could have been an isolated type circuit breaker. I am not familiar that much with the way that is done, but from the report that I was told, and here again this is strictly hearsay, sir, I am only giving you an opinion of what was told me because I wasn't there to trip the circuit breaker or whatever, it is only hearsay, but on that circuit breaker, what I was told, that it does not make a noise. It only has a white appearance to the circuit breaker.

If it pops or a light comes on or anything like that, so far as the observation is concerned, concerning that particular circuit breaker, all I know is that it was told to me that it did trip and it could have been one of the circuit breakers for the flushing mechanism or something else.

It did trip. It was tried to be reset and it did not reset, so if it is not reset, then it has completely shorted out, in other words, beginning this problem. That is one of the reasons why it probably couldn't reset, that it had actually just blew.

Mr. SNYDER. In your opinion as an electrical engineer, the fire could have started either from the original short that caused it to trip or from the attempt to reset it, which sent the additional current.

Mr. GRUBBS. It could have been done either way. It would be very, very difficult, gentlemen, to really determine that unless you went through a tremendous amount of evaluation, a tremendous amount of trying to duplicate or try tc simulate that particular type of circuitry.

Mr. SNYDER. You indicated that the smoke was so thick you couldn't see your hand in front of your face, or words similar to that. Did you determine from any of your discussions with any of the other people who survived how those who were further removed from the door found their way to the exits?

Mr. GRUBBS. Only the people that—Moseley said they got out pretty rapidly, when he opened the door himself or kicked the door in or whatever, and only the two gentlemen that were from Canada that I just explained about a few minutes ago, that they crawled on their hands and knees. One went off on one side and one went off on the other.

I did not discuss in the hospital, I tried to go shake everybody's hand and say that it is a privilege to meet them, but I wish it had been under other circumstances. It just was not much discussion, because I guess a lot of people were very, very still emotionally upset.

Mr. SNYDER. Since the electrical system was out and there were no lights and it was dark in there, at least from the smoke, were there any instructions given by any of the flight attendants to the passengers to please identify to yourself where the exits are so that you will know, or do you think people did that?

Mr. GRUBBS. As far as my recollection is concerned, sir, there was no communication other than the first one of saying "Please move to the front of the aircraft," when the smoke first started, and the only brief communication I heard when the cockpit door was opened between the pilot and, or whoever it would have been, whether it was the aircraft controller that was in the Indianapolis area, and we were going to be, that the airport had been cleared for the emergency landing. That is about all that I can really remember. Everything happened so fast.

You can figure 31,000 feet and making a quick descent like we did from Indianapolis to Cincinnati Airport is not very far, and we made a pretty rapid descent, and even the sensation of making that type of rapid descent, I just don't——

Mr. SNYDER. Is it your opinion that you were in the Indianapolis area?

Mr. GRUBBS. I heard the communications from the cockpit.

Mr. SNYDER. Let me just make this explanation to you. As I understand it, both from news reports and from testimony yesterday, the emergency was declared when the aircraft was approximately 25 nautical miles southwest of Cincinnati, that is the Cincinnati airport, which is of course, as you know, over Boone County, KY.

Mr. GRUBBS. Right.

Mr. SNYDER. But it is also true that en route aircraft in that whole area all the way down, almost to the center border, are under the control of what they call Indianapolis Center.

Mr. GRUBBS. Exactly.

Mr. SNYDER. If it is going on through, and of course it is only turned over to a local airport if they are going to land or go through their control zone. You don't think there is any question in your mind but what they said they were in the vicinity of Indianapolis rather than under the control of Indianapolis Center?

Mr. GRUBBS. That is the way that I heard it.

Mr. SNYDER. The way you understood it.

Mr. GRUBBS. The way I understood it. It could have been the aircraft controller at the Indianapolis Airport giving the pilot directions to go and prepare. They had Cincinnati International closed down for the landing due to the altitude that we were flying, they knew that he couldn't have got into Indianapolis, so there was a time lag that I feel like that Cincinnati was the best way to get down.

Mr. SNYDER. I think it was the closest.

Mr. GRUBBS. The closest location.

Mr. SNYDER. The closest air carrier airport.

Mr. GRUBBS. Right, that we could get down and shut down, and isolate in that period of time.

Mr. SNYDER. Was there any increased visibility when the door opened?

Mr. GRUBBS. You know, I didn't pay that much attention to it, but I did see that breath of air, and I went out. When you see daylight in a situation like that, if it had been smog and had one of those Texas tornados, I would have enjoyed it.

Mr. SNYDER. I understand. I appreciate your being here. Thank you.

Mr. GRUBBS. Thank you, Mr. Snyder.

Mr. LEVITAS. Thank you, Mr. Snyder.

Mrs. Johnson.

Mrs. JOHNSON. No questions.

Mr. LEVITAS. Thank you. I have a few more questions, Mr. Grubbs, that might add a little more to our information.

Could you describe the configuration of the seating in the DC-9? For example, was it a one-class plane or was there a first-class and a coach section?

Mr. Grubbs. On that particular flight, it was only a one-class. We were treated, of course, the beverage served, there was no charge. It was more or less a business type flight aircraft. It was kind of strange too in a way, that the smoking to me seemed like it was kind of mixed up. Normally the rear of the aircraft is smoking, but from where I was sitting, it was kind of a strange situation, and I didn't pay any attention to it because they know what they are doing. They run their own aircraft, and I am only a passenger on it.

But, no, there was no first class. It was all a one-class type flight.

Mr. Levitas. And as far as the seats were concerned, I take it they were two abreast on the left and three abreast on the right?

Mr. Grubbs. Exactly.

Mr. Levitas. You anticipated one of my questions about the smoking-no smoking sections. Is it your recollection that there was not the forward part of the cabin dedicated to smoking, and the back part for nonsmokers, or it was arranged in some other fashion?

Mr. Grubbs. Normally on every aircraft that I have flown on, smoking is always at the rear of the aircraft. This particular flight I know that people were smoking probably two to three rows ahead of me, because there just weren't that many people on the plane. If it had been a full load of passengers on the plane, it would probably, I would say, have started around maybe 16 through the rear of the aircraft. There were maybe two rows ahead of me that were smoking, but I would not guarantee that.

Mr. Levitas. When the smoke began to fill up in the cabin and get darker, as you have described it, do you recall whether the smoke was evenly distributed from the top of the cabin down to the floor, or was it more heavily concentrated on the top with less smoke at the bottom?

Mr. Grubbs. More smoke to the top of the aircraft. As we all know, that smoke rises, and the smoke was at the floor from my only observation that I saw, that it was just rolling out of the top of the return air vents, and then it became the whole environment because there was no oxygen aboard the aircraft. There was no way that you could get any vent to it to make it circulate. So it just filled up like you would take a jar and fill it full of smoke and then close the lid on it. That smoke is there.

Mr. Levitas. When you moved up to the front of the aircraft near the cockpit, did you notice whether there were any flight attendants or cabin attendants behind you?

Mr. Grubbs. No; sir, I did not. At that time it was getting very dark on the aircraft. I would probably say, sir, that probably the two stewardesses and probably the steward were at the front of the aircraft.

Mr. Levitas. So to the best of your recollection they were up front?

Mr. Grubbs. To the best of my recollection.

Mr. LEVITAS. Prior to your flight on this DC-9, this event, had you ever discussed or given any thought to materials used in aircraft cabin interiors?

Mr. GRUBBS. No, sir; I sure have not. Only in the transit I know that they have been very, very concerned about schoolbuses, about transit buses. That is what I am dealing with now, myself, about flame retardant type materials, toxic type materials, and anything that moves people, and the transit industry through APTA, through the big organization that they do have, has more or less really put the pressure on the transit authorities to use products of this nature.

It costs more money, it is more expensive. It is a little bit heavier in weight. The aircraft industry, the lighter that they can get any type of material, the major thing that the transit looks at is fuel economy, and if you start adding weight to any type of vehicle, whether it be an aircraft or an automobile or a transit bus or a truck, weight depletes fuel economy.

So the lighter the material, the stronger the material, whether it be toxic-nontoxic, flammable or nonflammable, in that nature; the transit industry has begun to use that, taking that emphasis quite strongly, primarily in schoolbuses and in transit buses for the protection of the people, if a crash occurred and you had a gas tank explode and fire would be aboard, would they get toxic and couldn't get out.

Mr. LEVITAS. My last question is this, Mr. Grubbs. In light of this experience you have had, what would you, based on your own experience, urge the Government to do with respect to situations of the sort that you went through? What do you think that we in the Congress or the Federal Aviation Administration ought to be doing in connection with matters of the sort that occurred on the Air Canada flight?

Mr. GRUBBS. In my personal opinion, sir, that anything that anybody, any governing body, Congress, Senate, or Federal Aviation can do, anything to force, to make it into a law that they have to have certified materials that are nontoxic, that are flammable to a very, very minimum, you are not going to get all of the toxic out of it, but you can keep it to a minimum that you are not going to be in a situation that I was in, and make it a law that either they do it or they don't use that vehicle, to save human life, because you can replace an airplane, but you cannot replace a human life.

So anything that all of us could do as a person, as a governing body to try to get these things done, for the safety of the people of the United States, and if you had been in the same situation or anybody in this room had an experience, I think they would say and agree to the same thing.

Mr. LEVITAS. Thank you very much, Mr. Grubbs. Your appearance here today and what you have shared with us from your own experience has certainly shed a great deal more light on what happened, and I think has indicated to us areas that we need to explore as we proceed in these important hearings.

Mr. Molinari.

Mr. MOLINARI. I have a few more questions, Mr. Chairman. I will try to be brief.

Mr. Grubbs, did you notice if there was any delay in the original takeoff?

Mr. **Grubbs**. No, sir. It was, like I said, a very nice flight.

Mr. **Molinari**. Other than being a nice flight, do you have a recollection that it left on time?

Mr. **Grubbs**. Yes; we did. As a matter of fact, it was the first time in a long time that we had been pretty well on schedule.

Mr. **Molinari**. When the smoke was filling up the aircraft, did you become aware of any heat?

Mr. **Grubbs**. There was no heat in that aircraft. There was no flame, and as far as the heat is concerned, if the air-conditioning was not going, it was like, you know, walking into a room in your house, you know, that had been shut off, but there was no heat, nothing unbearable as far as the heat is concerned.

Mr. **Molinari**. Right up to the point of landing?

Mr. **Grubbs**. Right up until after the doors were opened; then you could, as I personally didn't feel it, but Moseley said he felt it, a blaze of heat at his back when he got out of the exit door.

Mr. **Molinari**. Mr. Grubbs, you mentioned before that they did serve a meal. Since it would appear from your testimony that the fire occurred in the galley area rather than lavatory side of the plane, how long was it after the meal was served before the smoke condition was discovered?

Mr. **Grubbs**. How fast was it?

Mr. **Molinari**. In other words, you did have a meal. They cleaned up. Was it shortly thereafter that this condition occurred?

Mr. **Grubbs**. Shortly thereafter, because taking that flight several times on a DC-9 of this nature, you always get up to cruising altitude or starting to approach cruising altitude before they will start serving meals, so we were up in the air probably an hour. I think that flight time from Dallas to Toronto Airport is about 2 hours and 50 minutes, and we could have been halfway, so it happened shortly after the evening meal.

As far as putting a time on it, you don't pay attention to time. As a matter of fact, they had served a glass of wine, and the wine, my wine glass was still full, setting on the seat, the tray to my left. So it was just a short amount of time after that; if you want to put it in seconds or minutes, I could not tell you, but it was not very long.

Mr. **Molinari**. The wine was served with your meal or at the conclusion of your meal?

Mr. **Grubbs**. Yes, it was, with the meal.

Mr. **Molinari**. One point that I would like to get into the record, Mr. Grubbs. I think in our conversation in the back room there earlier, you mentioned that there were two military passengers; is that correct? Did I understand you?

Mr. **Grubbs**. I can only say this, sir. That when the FAA investigators came to my office and sat down in front of my desk, they made this one statement. They said, "Mr. Grubbs, I don't want to make you feel any worse than the experience that you have gone through, and it is going to take quite some time for you to get over it, if you ever do, due to the memories."

He said, "If you had been sitting in your seat, you wouldn't have made it, but with all of the training that the pilot, that the crew and everybody goes through as far as air safety is concerned for crash, for fires or whatever," he did make this statement.

Now this is hearsay of what he told me, that even though they go through an extensive amount of training, and he could not understand why were there two pilots, now whether they were pilots from the Canadian Air Force going back to Canada or on a mission or something or going to a meeting, they perished in the aircraft, and they were still strapped in with their seatbelts.

Mr. MOLINARI. Do you know at what location they were seated?

Mr. GRUBBS. No; I do not.

Mr. MOLINARI. Just one last question, Mr. Grubbs. After you got out of the plane, can you describe what took place?

Mr. GRUBBS. After?

Mr. MOLINARI. After you got out of the plane safely, then what happened?

Mr. GRUBBS. OK. After the people came off, we went about 150 yards away from the aircraft. The ambulances started coming to us. We had made the head count and so on, that there were only 18 survivors, so they knew that there were 23 still aboard, the crew knew this.

They carried us to a building that you could still see the plane burning, away from the main terminal, and they had it pretty well secured, because the news media already started trying to get through the doors, and that is where they took us to, and I was one of the last ones to leave.

There was, whether it was news media or what, there were five people unaccounted for, and I was one of the five that they had to dispatch another ambulance to, where we were standing outside this small building. That is where we were making the phone calls at. I was one of the last five to get to the airport.

It was either a fire captain or a security officer or somebody plus the four people from Canada, four gentlemen and myself were the last ones to leave the scene of the airport and go to Boone County Hospital.

Mr. MOLINARI. Do you have any idea how long you were at the hospital?

Mr. GRUBBS. Yes. We got in there, the FBI came in there about 11 to 11:30 that night. We were probably at the hospital by 8 that night. I was released at 7 o'clock the following Friday afternoon, in the evening, and then I left, returned to Dallas on American Airlines 740 the next morning, Saturday morning on American Airlines.

Mr. MOLINARI. That is my last question. I do want to again compliment you for the contribution you are making here today. I know it is not an easy thing to live through something like this and then try to recount your experiences, but I am indeed very grateful for your help.

Mr. GRUBBS. Thank you, sir.

Mr. MOLINARI. Thank you so much.

Mr. LEVITAS. Mr. Grubbs, you just indicated that you flew back to Dallas, and I take it you have flown on more than one occasion since your experience on the Air Canada flight.

Mr. GRUBBS. Yes; I have.

Mr. LEVITAS. Do you have any reluctance or apprehensions about flying anymore?

Mr. GRUBBS. That is kind of a funny thing, sir. When I flew back, my wife, when she walked in there, she flew in that Thursday night and didn't get there until 10 o'clock Friday morning, the most beautiful sight I ever saw in my life when she walked in that hospital room.

We got a flight and she said that I was a very nervous individual, and she said my legs kind of buckled a little bit when I stepped on that plane to come home, and my first flight by myself, I had to fly out to Los Angeles, and kind of the circumstances, whether it was meant to be or what, I was on a DC-9 plane again, and we were cruising at 31,000 feet from DFW to Orange County Airport, and when we left from DFW going to Toronto, we were cruising at 31,000 feet.

The circumstances were kind of unique in itself, but I can handle it now. It is not a problem. I made a statement. They said, "Roy, would you ever fly again?" I said, "Yes, I will." I said, "If you were in an automobile accident, would you drive again?"

Mr. LEVITAS. And in light of this experience and the fact that you are prepared to continue to fly, do you do anything differently as far as your conduct or habits or procedures now that you fly that are different from what you did before the Air Canada accident?

Mr. GRUBBS. I don't do anything any different except I sure do smell a lot.

Mr. LEVITAS. Thank you very much, Mr. Grubbs. You have been most helpful. I appreciate your being here. You can be excused.

The next witness is Ms. Janis S. Saito, director of air safety, the Association of Flight Attendants.

Let me make this announcement. We will go for about another 20 minutes or so, and then we will recess for lunch and then resume the testimony following that, complete your testimony, and hear from the witnesses from the International Association of Fire Fighters.

Thank you very much, Ms. Saito, for being here. We appreciate your participation. You may proceed as you so desire. If you will identify yourself, your position, and your organization at the outset, it would be helpful.

STATEMENT OF JANIS SAITO, DIRECTOR OF SAFETY, ASSOCIATION OF FLIGHT ATTENDANTS

Ms. SAITO. Thank you.

Good day, Chairman Levitas and members of the subcommittee. My name is Janis Saito. I am the director of safety of the Association of Flight Attendants. AFA is the collective-bargaining representative of 21,000 flight attendants employed by 14 carriers.

I will briefly summarize my written testimony that I submitted to the committee.

Mr. LEVITAS. Your entire statement will be made part of the record.

Ms. SAITO. Yes.

Mr. LEVITAS. You may proceed as you so desire.

Ms. SAITO. I want to thank you for the opportunity to appear before you today to address survivability in aircraft accidents. This topic covers a broad range of AFA's safety concerns. We would like to focus our testimony on the need to upgrade flight attendant emergency training, problems and safety hazards of carry-on baggage, and protective breathing devices for flight attendants.

Our testimony will strongly emphasize the need for stricter regulations of flight attendant emergency training. We will be giving examples of errors made by flight attendants because they were trained incorrectly. This is a highly sensitive area to our organization and to our membership, and we do hope that you will appreciate the fact that we are opening ourselves up and exposing our errors, in the hopes that we can educate you on the problem that exists and has existed for many years, and we would like to see improvements made in this area.

There are hundreds of examples of flight attendants performing faultlessly and saving countless lives. We want to remind you of that fact. We are testifying because what we seek is to see the training standardized and upgraded. The airline industry was on the track toward improved high quality training before deregulation in 1978. Since then, economics have caused the downgrading and elimination of necessary training.

In our written testimony I have outlined the present Federal regulations addressing our training. When we are first hired, we are required to go through initial training of 16 programmed hours of instruction. This training will be the basis for all subsequent training. Thereafter airlines are required to hold recurrent training once a year for 12 hours.

However, it is a regular procedure for the FAA to grant exceptions to this, and we see that the average of the carriers we represent to be between 6 and 10 hours each year. Emergency drills and instruction in emergency equipment are only required to be covered every 24 calendar months.

Fulfillment of the emergency training requirements can be accomplished in many ways. We see mostly a combination of hands-on training and training booklets with slides, but because the FAR's are silent to the prescribed form that training should encompass, as a union that represents 14 carriers, we see a wide range of forms.

For example, to train on smoke evacuation, one carrier we represent fills a simulated cabin with a smoke substance and the training group learns to maneuver through the aisles to reach the emergency exits and to locate missing passengers. Another has flight attendants put on smoke goggles to simulate actual crash conditions. The lens of the goggles are painted grey to obscure one's vision. Yet we have another that handles it through a written question: What would you do if a fire was reported onboard? All three examples satisfy the regulation.

Over the years, we are seeing the skills required by us tested more by true-false, multiple choice and fill-in-the-blank quizzes than by mock-up drills. During the FAA's recurrent training for their principal operating inspectors last year, it was reported by many POI's that while conducting on-line checks when they approached flight attendants and asked them about the emergency equipment, the flight attendants could easily recite the location and operation of the emergency equipment, but when asked to get that equipment, a large number of flight attendants were unable to unbracket it.

In reports regarding accidents during the past 12 years, the NTSB has repeatedly cited poor training as contributing to flight attendant errors. A good example is the reported use during recurrent training, many times we use mock doors or we use actual doors without the girder installed, without simulated tension. The lack of tension tends to mislead the flight attendants to anticipate the required force needed to deploy the slide.

In an emergency evacuation in Casper, WY, in 1975, flight attendants did not open the front and aft doors, because it appeared to be jammed. In the report, it was noted that they were trained on a 737 mockup without the girt bar attached or without a mechanism to simulate the resistance that the attachment produced. Therefore, when they rotated the door handle, it appeared that the door had buckled and was jammed; and in fact it was in normal working use and they could have opened the door and used the slides to evacuate the passengers.

The NTGB report stated that "Neither of the flight attendants were adequately prepared to anticipate the forces necessary to open the cabin door in the emergency mode."

In another accident involving a DC-9 aircraft, during the evacuation, the aft flight attendant opened the aft door and proceeded into the tail cone area. They were taught to jettison the tail cone which will make that a usable exit. She went to the back tail cone, and she could not find the release handle. She had never been in the tail cone before, and she had been taught in ground training to look for the handle at shoulder height, and in fact where it is located is down below on the floor. In the dim lit surroundings and unfamiliar parts of the plane, finding the release handle was a problem, and she never did find the handle.

Problems in training do not lessen when they use the actual aircraft in training. One of the faults in using the actual aircraft is that drills are very carefully controlled. Fear of damage to the aircraft and the emergency equipment as well as the desire to not disturb any parts and necessitate replacements produce a very sterile, unrealistic training for flight attendants.

For example, we have DC-10's and L10-11's that have an emergency door system and it requires a flight attendant only to actuate a handle, and when that handle is actuated, the door automatically opens, deploys, and inflates the slide. This is what we are supposed to do during an emergency.

These doors also have a feature called an emergency override system, which allows the door to be activated without deploying or inflating the escape slide. This feature was designed for evacuations at gateways.

The emergency override system has become a very convenient means to demonstrate the emergency door system during initial training without bothering the slide system. However, it has become a serious source of problems in an emergency. During extreme stress, people will react in the manner they have been trained through repetition. In this way, when an emergency happens, the person will not have to think. She or he will just react with a trained reflex.

The disadvantage of using the override system for training is that the flight attendant is making a very conscious effort every recurrent training to assure that the override mode is actuated so that the expensive slide is not deployed. Not surprisingly, in a firey aborted takeoff in March, 1978 at Los Angeles, a DC–10 had nearly half of its exits disarmed in this manner.

If the flight attendants had not caught their errors, they would have opened the doors and the slides would not have been available for passengers to get out of. All but one realized their error and they were able to evacuate successfully.

We have also seen a failure in training flight attendants in available backup systems. In November 1980, a Boeing 727 cargo passenger aircraft crashed on landing at Yap Airport. The aft flight attendant attempted to open the pressure door leading to the airstairs. The normal handle failed. As the cabin filled with thick smoke, the flight attendant made her way to the window exit where she exited.

From the NSTB accident report, it was disclosed that she, her partner, and all the newly trained flight attendants had never been trained in the usage of the pneumatic tail slammer. This is the backup system on cargo-passenger aircraft. Their mock-up did not show this backup feature nor did the manual show a description of its working.

This is a quote from the NTSB report:

> Based on the statements of the flight attendants, some persons might have been trapped and killed by smoke and fire if the evacuation had taken only seconds longer. The loss of more than one-half of the exits because of impact damage and fire made a timely evacuation all the noteworthy. The fact the airstair exit was not opened was nearly catastrophic because one flight attendant and some passengers were almost trapped in that area. It could not be determined if the pneumatic emergency blow-down system would have forced the exit open; however, the fact that the flight attendant did not know how to actuate the emergency system is a serious concern. Her repeated attempts to open the exit using the normal system delayed her evacuation to a point where she was nearly trapped by smoke and fire. (NTSB-ARR-81-7, page 24.)

Automatic inflation slides also are equipped with a backup system. And, again, we have noted that flight attendants when the normal inflation system does not work, have not used the backup system. Air carrier operations bulletin noted that in 89 slide deployments, 6 failed to inflate automatically. However, when they went back to inflate these 6, all but 1 responded to the backup system, the manual inflation handle.

The reason why the flight attendants did not pull on these inflation handles is that we have a nonstandardization on aircraft, and when we fly different aircraft, we need to know all the different equipment onboard, and many times we have to learn where the inflation handle is on all different types of aircraft, and there is a confusion that occurs when flight attendants, when they are accustomed to look for an inflation handle on the slide pack, and they happen to be in a plane where the inflation handle is on the door.

Most of the transfer teaching is done by book, and we feel that it doesn't always leave a very strong enough impression so that lessons are recalled in a second's count emergency situation.

Surprisingly, we have book learning as the method used to teach how to fight a fire. The majority of carriers do not let flight attendants discharge a fire extinguisher during recurrent training. We are taught to recite "Aim the nozzle at the base of the fire and discharge." The few that do have hands-on training have the flight attendants discharging the extinguisher into a waste basket or into a pan.

Mr. LEVITAS. Ms. Saito, let me interrupt you at this point. There is a vote going on on the floor now, and we are going to have to go over and record our votes. I would suggest that we stop at this point. Your testimony is extremely important, and we don't want to miss any of it, and we don't want you to short-circuit it.

So I suggest that the committee stand in recess until 1:30, and we will resume at this point, and continue until we have completed the testimony.

Thank you very much.

Ms. SAITO. Thank you.

Mr. LEVITAS. The subcommittee will stand in recess.

[Whereupon, at 12:10 p.m., the subcommittee was recessed, to reconvene at 1:30 p.m. the same day.]

AFTERNOON SESSION

Mr. LEVITAS. The subcommittee will please come to order. When the subcommittee recessed, we were receiving testimony from Ms. Saito. You may now proceed.

Ms. SAITO. Thank you.

Another area where the book form and video slide presentation has proven inadequate is in the training of our ability to assess the suitability of the evacuation slides. Many of us have never seen the chutes inflated except in pictures and drawings.

In the written statement I have cited three accidents where numerous injuries were caused by going down slides that were either not fully inflated or were at angles that were too steep. From the point where the flight attendant is standing, she or he is looking down on the slides. Pictures are usually taken from the slide to show the full length of the slide or from the bottom looking up. For many of us looking down on the slide in an evacuation is a first-time experience.

Last year Japan Airlines finished a simulator, a double decked aircraft with doors from every aircraft they operate, half over a pool in which water can be added for wet ditching drills. Smoke, fire, noises, and decompressions can all be simulated. Flight crews, which is the pilots, copilots, flight engineers, and flight attendants, attend the emergency training classes together. The benefits to joint training is that crew coordination and performance are enhanced when all crewmembers know their respective duties as well as the duties performed by others.

AFA feels we have proven the need to upgrade emergency training for flight attendants. Realistic, dynamic training, as well as joint crew coordination training would improve everyone's chances of survival.

We also offer that present regulations need to be rewritten to include specific methods of instruction and acceptable levels of proficiency.

In regards to carry-on baggage, we have had a long battle for strict FAA regulations to restrict the size and amount of carry-on baggage brought aboard the aircraft. In 1975, during the FAA operations review, AFA testified to this fact. We do have a regulation which was revised in 1980 regarding carry-on bags, but the problem still exists, and too many bags are allowed onboard.

So 8 years later we are once again recommending the same proposal. We are seeing in the 1980's strong trends shaped by the economic environment. Aircraft are being reconfigured to higher density seating and airlines are restaffing the planes with minimum FAR crew numbers. A flight attendant's preflight duties are being consumed by helping passengers find secured storage for their extra bags and fragile items.

Most carriers do have a policy restricting the number of carry-on bags, but few enforce them with any regularity. When checking in for a flight, how many of you are ever asked "Do you have more than two carry-on bags, and can they be stowed beneath the seat or in the overhead compartments?"

The question most commonly asked is "How many bags are you checking in?" There is a weight limitation of 40 pounds for each overhead compartment bin, but how often, as a passenger, are you sitting beneath a bin with luggage that exceeds the limits? How is the weight limitation ever monitored?

These overhead compartments have never been dynamically tested. During turbulence, luggage can become flying missiles. How many of us have been on flights when you have encountered any turbulence or you have a hard landing, and those compartment doors spring open? In an emergency, quick evacuation becomes impeded by luggage littering the aisleways and exits, and in a cabin fire, carry-on baggage becomes a source of fuel.

In the long and arduous task of improving cabin safety and increasing accident survivability, we feel that it would be a major contribution if we could have a regulation that would be strictly enforced to ensure that carry-on baggage is the size and weight that can be accommodated by our aircraft.

The final safety measure of concern to us is protective breathing devices for flight attendants. We see people dying in survivable aircraft accidents because they have been overcome by the effects of smoke, heat, and toxic fumes. One of the most effective means to increase survivability in aircraft accidents is by decreasing the evacuation time of the occupants.

As Mr. Grubbs pointed out in his testimony this morning, there is a crucial time between the crash to the time that you become incapacitated, and then toxic fumes become lethal. The final count of fatalities caused by these factors are related to how quickly the passengers and crew members can exit the aircraft.

Past accidents and studies have shown that half the door and/or slides have been rendered inoperable due to the fire's radiant heat, blockage of exits and other related difficulties. This is the environment we find ourselves in, in a fire emergency.

We also find one of the problems that was pointed out yesterday as well is that without fire protective devices for flight attendants, we cannot often get to the source of the fire. It is difficult for us to get close enough to the fire to extinguish them with our extinguishers. Extinguishers we do have onboard are very good. They extinguish the flame very well, but if you cannot get to the source of the flame, then you cannot extinguish a fire.

We have been a long advocate of protective breathing devices for our crewmembers. The oxygen mask we are now given is suitable only for decompression emergency and medical care. We do not have any equipment that allows us to see and breathe in a smoke-filled cabin.

Some of the early body effects of a smoking environment are choking and difficulty in breathing with eventual loss of consciousness, involuntary eye closure as a natural defense mechanism; and confusion and irrational behavior caused by hyperventilation.

We, the flight attendants, are subject to the same debilitating conditions as the passengers, and yet in an emergency passengers look to us to find the usable exits and to lead them out.

In the final report of the SAFER committee, it recommended that the FAA evaluate the use of self-contained smoke masks as well as other personal protection equipment for crewmembers. The NTSB has also made this recommendation many times.

Flight attendants have done a remarkable job in saving lives. We have done it without any protective garments or equipment at great risk to our own lives.

I have been shown many examples of hoods and smoke masks that are available now. They are lightweight and heat resistant and quickdonning. They have been tested with good results.

British Airways, Swissair, and Monarch Airlines have emergency escape hoods for their crewmembers.

We endorse the SAFER and NTSB recommendations and hope to see some form of protective breathing device onboard U.S. carriers.

Because of the time restraints, because others have been giving testimony covering these subjects, we did not talk about other safety concerns that AHA strongly supports.

For the record, we feel that the following improvements are also needed: smoke detectors and automatic fire extinguishers in the lavatory and galley areas; improved cabin emergency lighting; greater seat strength; required materials in the cabin that are low in flammability, toxic fumes and smoke emissions; standardized life vests; and a flight-time duty time regulation for flight attendants.

Thank you very much. This concludes my testimony for today.

[The prepared statement of Janis Saito follows:]

PREPARED STATEMENT OF JANIS SAITO

Good day, Chairman Levitas and members of the subcommittee. My name is Janis Saito. I am the Director of Safety of the Association of Flight Attendants, the largest flight attendant union in the United States. AFA is the collective bargaining representative of 21,000 flight attendants employed by 14 carriers.

Thank you for the opportunity to appear before you today to address survivability in aircraft accidents. This topic covers a broad range of AFA's safety concerns. We would like to focus our testimony on the need to upgrade flight attendant emergency training, problems and safety hazards of carry-on baggage, and protective breathing devices for flight attendants.

EMERGENCY TRAINING FOR FLIGHT ATTENDANTS

Our testimony will strongly emphasize the need for stricter regulations of flight attendant emergency training. We will be giving examples of errors made by flight attendants because they were trained incorrectly. There are hundreds of examples of flight attendants performing faultlessly and saving countless lives. We want to remind you of that fact. We are testifying because we seek to see the training standardized and upgraded. The airline industry was on the track toward improved high quality training before deregulation in 1978. Since then, economics have caused the downgrading and elimination of necessary training.

Presently, Federal Air Regulations 121.415, 121.417, 121.421, and 121.427 address the training required to become and remain a qualified flight attendant. Each newly hired flight attendant must go through a basic indoctrination of 16 programmed hours of instruction. Required subjects are duties and responsibilities of the flight attendant, appropriate FAR's emergency training, the authority of the pilot in command, passenger handling and a knowledge of each airplane type as it pertains to your duties. This training will be the basis for all subsequent training. Therefore, airlines are required to hold recurrent training once a year for a total of 12 hours. However, it is a regular procedure to grant exemptions to this regulation and therefore we find the average to be between 6–10 hours. Emergency drills and instruction in emergency equipment are only required once each 24 calendar months. Fulfillment of the emergency training requirements can be accomplished in many ways. Carriers use mostly a combination of hands-on training and training books with visual aides, but because the FAR's are silent as to the prescribed form that training should encompass, as a union that represents 14 carriers, we see a wide range of forms. For example, to train on smoke evacuation, one carrier we represent fills a simulated cabin with a smoke substance and the training group learns to maneuver through the aisles to reach the emergency exits and to locate missing passengers. Another has flight attendants put on smoke goggles to simulate actual crash conditions. The lens of the goggles are painted grey to obscure one vision. Yet we have another that handles it through a written question—what would you do if a fire was reported onboard? All three examples satisfy the regulation.

Over the years, we are seeing the skills tested more by True-False, multiple choice and fill in the blank quizzes, than by mock up drills. During the FAA's recurrent training for their Principal Operating Inspectors last year, it was reported by many POI's that while conducting on-line checks, flight attendants could easily recite the location and operation of a piece of emergency equipment, but when asked to get that equipment piece, an alarming number of flight attendants were unable to unbracket it.

In reports regarding accidents during the past twelve years, the NTSB has repeatedly cited poor training as contributing to flight attendant errors. A good example is the reported use during recurrent training of mock doors or actual doors without girt bar tension or simulated tension. The lack of tension misleads the flight attendants to anticipate the required force needed to deploy the slide. On March 31, 1975 a 737 landing in Casper, Wyoming overran the runway and came to rest on its belly with its engines ripped away. The forward flight attendant attempted to open the forward door. She rotated the door handle but the door appeared jammed. The aft flight attendant rotated her door and it also appeared jammed. The NTSB report (AAR-75-15 p. 36) stated that both of these flight attendants had been trained on a 737 mock up with an actual 737 door. This airline's door mock up did not have a girt bar attachment or a mechanism to simulate the resistance that the attachment produces. In the course of a work day, flight attendants never open the door with the girt bar attached. Therefore neither flight attandant nor any others in the workforce had ever experienced the force needed to open the door with the slidebar in place. The report stated they "noted that the forces required to operate mockup door was noticeably less than those required to open an actual aircraft door with the slide pack attached. Thus we believe that neither of the flight attendants was adequately prepared to anticipate the forces necessary to open the cabin door in the emergency mode."

Another case to highlight the pitfalls of inaccurate presentations in mockups is demonstrated in the DC-9 accident at Denver, Colorado on November 16, 1979. In this accident, takeoff was rejected when a stall-warning stick shaker activated at rotation. The aircraft then overran the runway, traversed a drainage ditch and came to rest with all gears failed and the left side of the aircraft on fire. The aft flight attendant opened the plug door leading to the tail-cone exit. She stated she was "startled" by the low intensity of the emergency lighting. She entered the tail cone area and was unable to find the release handle because of the darkness. In this accident, a passenger located the handle and successfully deployed the tail cone. Later during an interview, the flight attendants stated that they believed the handle to be at shoulder height, and that they had never been in the tail cone. Later questioning of ten other line flight attendants also stated they too had never been in the tail cone of the DC-9. Since the actuation handle is located outside of the illumination of the emergency lighting and because of the dark red colour, in a high-risk emergency situation, it becomes a problem to locate unless you have gone into the tail cone and looked at it under normal lighting.

This airline's recurrent training included operation of the tail cone release handle, but the fact that the mock up is in a brightly lit classroom may have developed "unrealistic perceptions of what to expect under emergency conditions." NTSB-AAR-77-10 P.21

It is also worthy to note the forward flight attendant stated she was "surprised at the additional force required to open the door with the slide attached". NTSB-AAR-77-10 P.16

Problems in training do not lessen when airlines use the actual aircraft for hands on training.

One of the major faults in using actual aircraft is that drills are very carefully monitored. Fear of damage to the aircraft and the emergency equipment as well as the desire to not disturb any parts and necessitate replacements produce a sterile unrealistic training.

Wide bodied aircraft such as DC-10s and L-1011s have an emergency door system that requires a flight attendant only to actuate a handle to have the door automatically open, deploy and inflate the slide. These doors have a feature called emergency over-ride, which allows the door to be activated without deploying or inflating the escape slide. This feature was designed for evacuations at gateways.

The emergency over-ride system becomes a convenient means to demonstrate the emergency door system during recurrent and initial training without bothering the slide system. However, the training actually becomes the source of problems in an emergency. During extreme stress, people will react in the manner they have been trained through repetition. In this way when an emergency happens, the person will not have to think. She just reacts with a trained reflex. The disadvantage of using the over-ride system for training is that the flight attendant is making a conscious effort every recurrent training to assure that the over-ride mode is actuated so that the expensive slide is not deployed. Not surprisingly, in a fire aborted take off in March 1978 at Los Angeles, a DC-10 had nearly half of its exits disarmed in this manner. Fortunately, most of the flight attendants realized their error prior to activating the door handle. One did not realize her error and opened her exit without the slide attached. In the case cited above, we would have had many more deaths if the flight attendants had opened their doors without activating the slides.

There has also been a failure in training flight attendants in available backup systems. On November 21, 1980, a Boeing 727-90 cargo passenger aircraft crashed on landing at Yap Airport. The aft flight attendant attempted to open the pressure door leading to the airstairs. The normal handle failed. As the cabin filled with thick, acrid smoke, the flight attendant made her way to the window exits where she exited. From the NTSB accident report (AAR-81-7-P. 24) it was disclosed that she and her partner as well as all newly-trained flight attendants had never been trained in the usage of the pneumatic tail slammer (the backup system on cargo-passenger aircraft). Their airline mock up did not show this back up feature nor did her manual contain a description of its working. "Based on the statements of the flight attendants, some persons might have been trapped and killed by smoke and fire if the evacuation had taken only seconds longer. The loss of more than one-half of the exits because of impact damage and fire made a timely evacuation all the more noteworthy. The fact the airstair exit was not opened was nearly catastrophic because one flight attendant and some passengers were almost trapped in that area. It could not be determined if the pneumatic emergency blow-down system would have forced the exit open; however the fact that the flight attendant did not know how to actuate the emergency system is a serious concern. Her repeated attempts to open the exit using the normal system delayed her evacuation to a point where she was nearly trapped by smoke and fire." NTSB-AAR-81-7, P.24

Automatic inflation slides also are equipped with a backup system. In a review of Boeing 747 emergency evacuations, Air Carrier Operations Bulletin No. 1-76-21 notes that in 89 slide deployments, 6 failed to inflate automatically. "Subsequent investigation revealed that no attemt had been made at manual inflation . . . " Once the manual inflation handle had been pulled, all slides were fully operable. The problem has been traced to transfer training on narrow and wide bodies aircraft by the method of training books along with visual aids. Manual inflation handles on narrow bodies are located on the slides whereas many wide bodied planes have the manual handle located at the hinge edge of the door. Flight attendants are accustomed to look for inflation handles on the slide pack and in recent accidents, have had trouble locating the manual handles. Transfer teaching by book does not always leave a strong enough impression so that lessons are recalled in a seconds-count emergency situation.

Surprisingly, book learning is the method used to teach "how to fight a fire". The majority of carriers do not let flight attendants discharge a fire extinguisher during recurrent training. Instead we are taught to recite, "aim the nozzle at the base of the fire and discharge." The few that do have hands on training have the flight attendants discharge the extinguisher into a wastebasket or pan.

Another area where the book form and video slide presentation has proven inadequate is in the training of our ability to assess the suitability of the evacuation slides. Many of us have never seen the chutes inflated except in pictures and drawings. Some slides have double lanes which may take 9—11.5 seconds to fully inflate. In Denver on a DC-10 a flight attendant began shoving passengers down a partially inflated slide causing many injuries. All her experience had been on 1 lane slides. We have seen numerous injuries caused by incorrect angling of the slide. Passengers sent down slides that were too steep suffered serious injuries in a San Francisco and Miami 747 evacuation. In another San Francisco accident, the slides were at 68° angle where they normally are at 37-40°.

Last year Japan Airlines finished a simulator, a double decked aircraft with doors from every aircraft they operate, half over a pool in which water can be added for wet ditching drills. Smoke, fire, noises and decompressions can all be simulated. Flight crews and flight attendants attend the emergency training classes together. The benefits to joint training is that crew coordination and performance are enhanced when all crewmembers know their respective duties as well as the duties performed by others.

AFA feels we have proven the need to upgrade emergency training for flight attendants. Realistic, dynamic training, as well as joint crew coordination training would improve everyone's chances of survival. We have observed that unless regulations are strictly worded and methods of compliance are specifically written, huge variances in quality will result. It is for this reason that we also offer that present regulations need to be rewritten to include specific methods of instruction and acceptable levels of proficiency.

CARRY-ON BAGGAGE

AFA has long battled for strict FAA regulations to restrict the size and amount of carry-on baggage brought aboard aircraft. In the 1975 FAA Operations review, AFA argued for a regulation to require passengers to present all bags upon check-in and to have a device present to monitor the size of all baggage allowed onboard. Although FAR 121.589 was revised in 1980, the problem of too many bags allowed onboard still exists and 8 years later, we are recommending the same proposal.

We are seeing in the 80's, strong trends shaped by the economic environment. Aircraft are being reconfigured to higher density seating and airlines are restaffing the planes with minimum FAR crew numbers. A flight attendant's preflight duties are being consumed by helping passengers find secured storage for their extra bags and fragile items. Although most carriers have policies restricting the number of carry-on bags to 1-2 per passenger, few enforce them with any regularity. When checking in for a flight, the question most commonly asked is "How many bags are you checking in?" rather then "Do you have more than two carry-on bags and can they be stowed beneath the seat or in the overhead compartments?"

There is a weight limitation of 40 lbs. for each overhead compartment bin, but how often are we sitting beneath a bin with luggage that exceeds the limitation? How is the weight limitation even monitored?

During turbulence, luggage can become flying missiles;

In an emergency, quick evacuation becomes impeded by luggage littering the aisleways and exits, and

In a cabin fire, carry-on baggage becomes a source of fuel.

In the long and arduous task of improving cabin safety and increasing accident survivability, protecting occupants from flying luggage and complying with weight storage specifications by monitoring the weight, size and amount of hand luggage seems paramount.

PROTECTIVE BREATHING DEVICES

People are dying in survivable aircraft accidents because they become overcome by the effects of smoke, heat and toxic fumes. One of the most effective means to increase survivability in aircraft accidents is by decreasing the evacuation time of the occupants.

The hazards of fire, smoke, toxic gases and flash fire vary in the timespan between the crash to the time they become incapacitating and then lethal. The final count of fatalities caused by these factors are related to how quickly the passenger and crewmembers can exit the aircraft. Past accidents and studies have shown that half the doors and/or slides have been rendered inoperable due to the fire's radiant heat, blockage of exits and other related difficulties.

AFA has been a longtime advocate of protective breathing devices for aircraft crew members. The oxygen mask we are given now is suitable only for decompression emergencies and medical care. We are not given any equipment that allows us to see and breath in a smoke-filled cabin.

Some early body effects of a smokey environment are:

1. choking and difficulty in breathing with an eventual loss of consciousness;
2. involuntary eye closure as a natural defense mechanism; and
3. confusion and irrational behavior caused by hyperventilation.

We are subject to the same debilitating conditions as the passengers and yet in an emergency, passengers look to us to find the usable exits and to lead them out.

In the final report of the Special Aviation Fire and Explosion Reduction Advisory Committee (SAFER), it recommended "that the FAA evaluate the use of self-contained smoke masks, gloves, clothing or other personal protection equipment for crewmembers in order that they can better complete emergency evacuation of occupants under the postcrash condition."

Flight attendants have done a remarkable job in saving lives. We have done it without any protective garments or equipment at great risk to our own lives.

I have been shown many examples of hoods and smoke masks that are available now. They are lighweight and heat resistant and quickdonning. They have been tested with good results.

British Airways, Swissair and Monarch Airlines have emergency escape hoods for their crew members.

We endorse the SAFER recommendation and hope that we will see some form of a protective breathing device onboard U.S. carriers.

Because of the time restraints and because others will be giving testimony covering these subjects, we did not talk about other safety concerns that we strongly support. But for the record, AFA feels that the following improvements are needed:

Smoke detectors and automatic fire extinguishers in the lavatories and galley areas;

Improved cabin emergency lighthing;

Greater seat strengths,

Required materials that are low in flammability, toxic fumes and smoke emissions;

Standardized life vests; and

Flight time/duty time regulation for flight attendants.

Thank you. This concludes our testimony.

Mr. Levitas. Thank you very much, Ms. Saito. Your testimony, in my opinion, is not only very pertinent, but it is powerful. As you said at the outset, it is unusual in that to a very large extent, it exposes, as you put it, the role of flight attendants, and many of the rather serious inadequacies that presently exist. For that reason, your testimony is of exceptional value to us.

The flight attendant on an aircraft is obviously essential to passenger safety in the event of an emergency, and far too often this role is minimized both by the carriers, by the passengers, and in some instances, I must tell you, by the flight attendants themselves. Your testimony and much of what we have already heard makes very clear the vital role for the difference between life and death that is made by the on-board crew and flight attendants. Therefore, some of the things that you have pointed out, and some other observations that we have received from other witnesses, and personal observations, I hope, will permit us to focus on this vital role.

You mentioned in the early part of your testimony emergency training or the lack of adequate training for flight attendants. One of the things that I have observed, and I think your testimony indicates, is the total lack of real world situations for training of flight attendants in emergencies. You made reference to telling people how to extinguish a fire by reading a book or reciting a phrase, or operating emergency exits in mockups or under circumstances that don't correspond to the real world.

I mentioned yesterday my observation of a safety training session of a class of new flight attendants, who were being shown how to use the evacuation equipment, and only about 5 out of maybe 30 or 50 people actually used the equipment. The rest of them were just evacuees.

In a word, Ms. Saito, do you think that the presentation and recurrent training is woefully inadequate, inadequate, all right, or just how would you categorize it?

Ms. SAITO. To give credit to the carriers we represent, they really do do a fine job in that they all are aware of the FAA standards. My main complaint is that the standards are so loosely written, and require so very little, that with all the new airlines starting up, with everybody's concern being economics at this time within our industry, that our carriers will look again at more cost-cutting measures, and will bring their training down.

We would also like to see the training upgraded, and I understand the practical aspects of having it would be one that doesn't require too much time, because you are being paid for it and taken off the line, and one that doesn't require too much equipment substitutions, but there has to be a regulation that forces every carrier to come up to a passable level, that doesn't allow carriers to have the great discrepancies that we are seeing now.

We don't represent a lot of the new carriers that have just started up, run by people whose main concern is to make a profit and market their airline. I think to the credit of the older carriers that have been around for many years, they have had the ability over a number of years to refine their training, and to get beyond much of the basic economic concerns. They are functioning, they are set up and they start turning to safety, and as I said in my testimony, we did see that the airline industry was on the right track, and giving us greater, better training. That has stopped.

Some of our airlines are already pulling back. We have seen our first aid training greatly decreased, and it is our concern that unless there is a strong regulation out there, that over the years we will see more and more of a lowering of safety training.

Mr. LEVITAS. Is there a requirement at the present time that flight attendants receive some training in situations such as that described by Mr. Grubbs in his testimony this morning? For example, in a smoke-filled environment inside a cabin?

Ms. SAITO. No. Well, we have not really been trained in in-flight fires. We have been trained on how to fight a fire, in my testimony.

Mr. LEVITAS. That is not very much training, though, is it?

Ms. SAITO. No, it is not, and once a fire has been controlled, there are verbal instructions we are given on how to have smoke evacuate out of the aircraft, but as far as—you are asking for exact training?

Mr. LEVITAS. Yes. Is there a requirement now that flight attendants have the experience of evacuating or going through emergency procedures in a smoke-filled cabin mockup?

Ms. SAITO. No. We are required to know the procedures of our company that we work for. We are required to know the procedures of an emergency evacuation.

Mr. LEVITAS. But you don't have a requirement, there is no requirement to go through an experience?

Ms. SAITO. A drill.

Mr. LEVITAS. Of an operation in a smoke-filled environment.

Ms. SAITO. No.

Mr. LEVITAS. You heard the testimony today, and this may be an unfair question. It is certainly a difficult question, but I would appreciate your candor. You heard Mr. Grubbs testify what occurred in the Air Canada accident.

Ms. SAITO. Yes.

Mr. LEVITAS. I don't have all the information, haven't spoken to all the witnesses, but my own recollection is that the cabin crew in that situation did not do what I would normally have expected a cabin crew to do in terms of handling the situation. Do you have any comment on what you have heard or know about the handling of that situation in the Air Canada accident?

Ms. SAITO. Well, first of all, from what I know of our carriers, we do not have instructions to pass out wet towels, or to instruct passengers that the clean air in a smoke-filled cabin is on the bottom and to crawl along, so those are things that have been widely spread by the press, and you may see more flight attendants doing that if they were in that emergency, but we aren't trained for that.

The other thing is we are trained to give verbal commands, and we are highly trained on how to evacuate an aircraft. However, if what Mr. Grubbs said was correct, and you couldn't get a breath of fresh air, I don't know how anyone could be screaming commands. Our position, and also the carrier's position, and one of our job requirements is that we do not have to stay in an aircraft and be the last one off. It is not required that we give our lives for our jobs, and I can't fault those flight attendants at all, given the circumstance.

Mr. LEVITAS. The situation involving carry-on baggage, have any of your members reported to you that the amount of carry-on barrage or whatever has come out of these bins on hard landings?

Ms. SAITO. Yes. We have quite a few. Either the bins are faulty or else the passengers haven't closed them securely, and they very easily pop open.

Mr. LEVITAS. Do you know whether there have been complaints filed with the carrier by flight attendants with respect to that type of situation?

Ms. SAITO. Flight attendants write it up all the time.

Mr. LEVITAS. And what type of response do you get from the carriers?

Ms. SAITO. All I can do, because I don't have this kind of feedback from the carriers we represent, is tell you I just came off the line. I was a flight attendant for 13 years, and I wrote it up continuously. I used to fly for Hawaiian Airlines, and the main part of our traffic is tourists, and they come on with these huge shopping bags filled with coconuts and everything that they have collected. It is a shopping mecca for them, and we have enclosed cabinets, and they open quite easily, and things fall out all the time, and we write them up.

Mr. LEVITAS. And what type of response do you get?

Ms. SAITO. We don't get a response. It has always been our position, flight attendants' position, that these things should be screened at the gate, at the check-in counters. Once passengers get on board with them, and we have our preflight duties to do, and they are boarding and they are trying to find space for all of their carryons, it is a big problem to get someone to surrender their bags so we can take it off, or to have someone surrender their foot area so we can use that for someone else's bags. It is a huge problem, and it is a safety problem also.

Mr. LEVITAS. You have participated obviously and seen demonstrations of evacuations, for training purposes and for other reasons. Do you recall whether in those demonstrations or in those training sessions the cabin that was being used had luggage or objects thrown around on the floor, in the aisles, like there would be in the event of a hard landing or a crash?

Ms. SAITO. No. In training, we don't simulate that at all. You don't want to incur this during your training. But if you are talking about certification——

Mr. LEVITAS. Yes.

Ms. SAITO. They do, to certify an aircraft, they go through a simulated evacuation, and they do put a few bags around. We have noticed that, over the years, it seems to take more and more tries in order to certify an aircraft, and it isn't a correct simulation in that you have got—the passengers on board anticipate a crash, they are healthy and they are not in a panic situation. They are usually employees of the manufacturer. The flight attendants are taken off the line at least 2 days before the simulated evacuation, given lots of rest, and trained over and over again to do it.

The environment within the cabin for the evacuation is very controlled. You have a few bags here and there, but you don't have the litter and the destruction that one usually sees in an aircraft, and still we don't have them evacuate the aircraft within 90 seconds.

Mr. LEVITAS. What you are saying is that these demonstrations and these training sessions do not in any way replicate the real world that a person would be in in the event of an emergency?

Ms. SAITO. No; they don't.

Mr. LEVITAS. One or two other questions along the line of training.

How much time does a flight attendant spend on safety training in the recurrent training program, and how often does this occur?

Ms. SAITO. Our recurrent training is once a year, once every 12 months, and I really can't say. There is a huge variance. Most of the entire recurrent training is on emergency procedures, emergency equipment.

Mr. LEVITAS. And in the original training program, when a new flight attendant comes on, how many hours do they spend before they can go out and work on a commercial flight?

Ms. Saito. There is a wide variance on that, too. We have some carriers that train flight attendants for 2 full weeks, others just for a few days, and the requirement is 16 hours. But in that initial training, they cover the history of the airlines, some etiquette, passenger handling, so it really is up to the individual carrier what they want to put into their initial training.

Mr. Levitas. Roughly what percentage of that initial training would be devoted to safety, and what percentage to marketing or service-related items or things that have nothing to do with safety?

Ms. Saito. I really can't say. I am sorry.

Mr. Levitas. Fifty-fifty, one-third, a tenth?

Ms. Saito. I think the majority is. At least 60 percent would be on emergencies.

Mr. Levitas. In the case of emergency exits, I asked this question yesterday, you have got these window exits, and some other exits where passengers presumably would be the people who might have to operate them. Is there any effort made to locate a passenger next to those exits who is young and strapping, like Congressman Molinari, as opposed to my example of the 78-year-old grandmother?

Ms. Saito. Yes. Most of the carriers have as part of their training, in order to secure the cabin for an emergency landing, part of your procedure usually always includes relocating able-bodied passengers to help you.

Mr. Levitas. Not on the original assignment, but in the event of an anticipated emergency relocating?

Ms. Saito. Yes.

Mr. Levitas. I see.

Ms. Saito. That is true. We have a problem. It is up to the company to have a policy on who will be assigned those seats, just in a normal flight. Many carriers allow small children and old people and disabled people to be at those window exits, to be assigned those seats.

Mr. Levitas. Have you received, or has your association received, complaints from flight attendants about the failure of the company or the captain to back up the flight attendant when passengers refuse to comply with safety procedures or smoking rules, and then the passenger complains to the carrier about the flight attendant?

Ms. Saito. Unfortunately, yes, we do. We have a lot of not only abusive language that comes from passengers, but we have been assaulted, and we have quite a big case on assaults on flight attendants, and unfortunately sometimes we are not backed up by our carriers or by the cockpit crew, and we are told to allow people who are already intoxicated to remain onboard, even though you can already tell before you takeoff that they are going to be a problem in flight. You have abusive passengers, and on a long night, that is a big problem.

Mr. Levitas. Yesterday I raised the question about minievacuation procedures, rather than full-scale evacuation demonstrations, particularly where a carrier has acquired new equipment that he never operated before. Has your association ever objected to this procedure?

Ms. Saito. Yes; we have. Do you mean to transfer training?

Mr. Levitas. Yes.

Ms. Saito. Yes; we have.

Mr. Levitas. And what response have you had so far?

Ms. Saito. We have not been successful.

Mr. Levitas. I have a number of other questions, Ms. Saito, but let me ask Mr. Molinari if he would like to ask some questions.

Mr. Molinari. I have a couple, Ms. Saito. I also agree with the chairman that this is a very comprehensive document, and it contains some rather serious charges. I think it is accurate to say that a number of the items that you have raised in your testimony pose a threat to your own membership. Would that be an accurate statement?

Ms. Saito. Yes. I have thoughts about submitting this, and when I kept looking at it, I realized that what people actually were asking for is to be trained, and I think we do a fantastic job right now, and there have been errors made, and I feel that the errors can be traced to our training rather than to——

Mr. Molinari. You are asking for a lot more than training. There are other questions raised in here of safety, putting too much weight in the overheads.

Ms. Saito. Yes.

Mr. Molinari. Items which could cause a serious problem for passengers as well as the attendants. The question I have is with such serious charges that are raised here, since you have such a large union, have you attempted through the power of the union to communicate these concerns to the FAA and the Safety Board, or to the carriers themselves?

Ms. Saito. Yes; we have.

Mr. Molinari. Would you mind expanding upon that answer for me.

Ms. Saito. Like in the carry-on baggage, and on the smoke masks, we have been asking for this formally through formal letters, through—everytime there is a hearing we will testify and request it. We do participate in the investigation that NTSB does, and we submit our recommendations for improvements in their reports, and during the different FAA meetings that they have had, hearings that they have had, particularly this 1975 review, we have participated heavily in that, and came in with pages of recommendations, and we stayed there fully and argued for each recommendation, and we weren't given it.

Mr. Molinari. I am sorry?

Ms. Saito. We weren't given the recommendations, all the recommendations that we have asked for, and that is why we are still here asking for the same things.

Mr. Molinari. They turned them all down, did they?

Ms. Saito. No; we did get some recommendations passed.

Mr. Molinari. Were there any items so serious that your union considered job action or striking?

Ms. Saito. No. You are asking if conditions got so unsafe, if we perceived the conditions to be so unsafe that they threatened the lives of our flight attendants, then we would ask them not to step onboard, but that is not so now.

Mr. Molinari. I think some of these could be life-threatening, certainly. The question, for example, of a breathing device—and by the way on that question, do you know of any equipment that would allow you to see and breath in a smoke-filled cabin? Are there any?

Ms. SAITO. Yes. I have been approached by a large number of different manufacturers, and what I keep telling them over and over again is that we don't endorse it, but I do collect the information, and I have seen some excellent samples. The sample that Mr. Grubbs talked about, the Scott protective hood, I have seen that, and that has been highly recommended to me.

Mr. MOLINARI. If Mr. Grubbs was wearing that hood, would that have enabled him to see?

Ms. SAITO. I don't think—no, not in that smoke-filled—he said he couldn't see his hand——

Mr. MOLINARI. Yes.

Ms. SAITO [continuing]. In front of his face.

Mr. MOLINARI. So it would have given him no greater visibility factor?

Ms. SAITO. No; but it would have given him oxygen.

Mr. MOLINARI. It would have given him some additional seconds, though, insulation from the toxic fumes. I suppose that would have been the main purpose in that?

Ms. SAITO. Yes. The main purpose for that would come with its own oxygen system, so someone could be able to give verbal commands. It has been tested. Flight attendants can continue to talk and be heard well with these hoods on, and so something like that would have worked very well and would have enabled flight attendants to give clear directions to the passengers to exit.

Mr. MOLINARI. You mentioned there were some airlines that had this hooded device.

Ms. SAITO. Yes. It is in the written report.

Mr. MOLINARI. I remember reading it. British Airways, Swiss Air, and Monarch. The emergency escape hoods that you are referring to there, they have an oxygen device as well?

Ms. SAITO. Yes. They have their own oxygen supply. The one that I saw that these three airlines use has their own oxygen pack. The hood goes over your head, and there is a netting on top that allows it to sit a little bit above your head. It has got an elasticized neck area, so you stretch it to go over your head, and then it pulls in. There is a pin to pull, that releases the oxygen into the mask, and it allows for peripheral vision. It allows for flight attendants to have beards and glasses on and things like that, and it allows for flight attendants to continue to breath and also speak.

Mr. MOLINARI. That is very interesting, because Mr. Levitas and myself visited Canada and we saw a hood.

Ms. SAITO. I saw that one, too.

Mr. MOLINARI. But there was no oxygen device attached to that as I recall. Let me ask you this because we are learning something new here that might be useful. Do you know what the supply of oxygen is in that unit or units?

Ms. SAITO. No; I don't. I have a complete booklet but I haven't read through it completely.

Mr. MOLINARI. You might tell us what a girth bar is.

Ms. SAITO. That is a metal bar that is part of the slide equipment, and that is the attachment that attaches the plane and is part of the slide. It keeps the slide attached to the plane, and there are hooks by your door that you insert the bar in, and you insert it after you have closed the door, and you are ready for takeoff, and that allows you when you open your doors and swing them open, it pulls the slide away from the container, drops it and inflates it automatically.

Mr. MOLINARI. In your training we have heard and read stories about some accidents where people inflated it when landing on water, the liferaft within the plane, and then couldn't get them out of the plane.

Ms. SAITO. Yes.

Mr. MOLINARI. What kind of training do you have with respect to that? Has that question been adequately covered, in your opinion?

Ms. SAITO. I know I feel that I have been adequately trained in that, and it is an accident that shouldn't happen, and it has happened, where the liferaft does not clear the door, and inflates inside the plane and blocks your exit. Within each liferaft container there is a deflation pick that is supposed to be adequate enough to puncture enough holes in it so that it deflates, and then you can use your exit.

Mr. MOLINARI. Where did you receive your training?

Ms. SAITO. Hawaiian Airlines.

Mr. MOLINARI. Hawaiian Airlines?

Ms. SAITO. Yes.

Mr. MOLINARI. One last question. You mentioned FAA exemptions that were granted on required training programs. Would you mind telling us in what circumstances that would be?

Ms. SAITO. The airlines, each airline has their own principal operating inspector, and you have to submit an outline of your full training, and it gets approved, and over the years, if a carrier can show that they can encompass the training necessary within a shorter amount of time, they are given approval to lessen the number of hours of training. Most of our carriers don't go 12 hours. The majority have all been granted exemptions. You see, 12 hours requires you to do it in 2 days, and that is expensive, so most carriers have brought it down to a 6- or 8-hour day.

Mr. MOLINARI. One day, a single day?

Ms. SAITO. One day.

Mr. MOLINARI. I have no further questions. Thank you very much.

Ms. SAITO. Thank you.

Mr. LEVITAS. Thank you, Mr. Molinari.

Dr. Rowland.

Mr. ROWLAND. Thank you, Mr. Chairman.

Ms. Saito, we heard this morning from Mr. Grubbs that after he got off of the aircraft he didn't see any members of the crew, and he in fact helped three people to get away from the aircraft. We heard you say that you are not expected to give your life for your job. Can you tell me what is expected as a matter of information? How are you instructed about what you are to do and how far you are to go? Is it individual initiative or do you have some rules?

Ms. SAITO. No. I think all carriers will allow you to use your own judgment at that time. There are so many factors, and no one but you can judge when it is that you feel that you have done as much as you can for the other passengers, and when you can exit yourself.

Mr. ROWLAND. We also heard Mr. Grubbs say this morning that he believes most passengers respect the smoking rules on aircrafts. Do you agree with him that most passengers do that?

Ms. SAITO. Most passengers do what?

Mr. ROWLAND. Agree with the smoking rules on aircrafts.

Ms. SAITO. What do you mean?

Mr. ROWLAND. Smoking rules. You know, you have rules for smoking cigarettes on an aircraft. Do you agree that most passengers respect these or not?

Ms. SAITO. Oh, most passengers following the smoking?

Mr. ROWLAND. Yes.

Ms. SAITO. They do, yes, they do, and we still have the problem of passengers smoking in the lavatories.

Mr. ROWLAND. That is against the rules?

Ms. SAITO. Yes; that is against the rules, and the majority of smokers don't do this, but we still do find cigarette butts in the trash containers, so we know that some people are still breaking the rules.

Mr. ROWLAND. This morning I asked a question about the circuit breaker, and Mr. Grubbs said that the person in charge, if that was the engineer or whoever it happened to be, in this instance pushed the circuit breaker back on. It tripped. He pushed it back on. It tripped. He pushed it back on as though to continue the circuit. Do you have any knowledge about what normal procedure is or how that is handled?

Ms. SAITO. No; I don't. The airline pilots will be testifying tomorrow, and I think they would be the appropriate party to ask.

Mr. ROWLAND. You haven't personally observed the circuit breakers being tripped?

Ms. SAITO. No.

Mr. ROWLAND. And then pushed back on?

Ms. SAITO. No; I haven't. That is in the cockpit.

Mr. ROWLAND. Thank you, Mr. Chairman.

Mr. LEVITAS. Thank you, Dr. Rowland.

Do you have any thoughts or suggestions about how the passenger safety information briefing can be made more significant than it is now, so that the passengers pay attention and get the message and can respond to it?

Ms. SAITO. I have seen two methods that work well. Everyone has become indifferent to the preflight announcements, and some carriers feel that passengers will, out of habit, watch a television screen more than they will a live flight attendant, so they have been putting their briefings on the screen, and they say that helps. I don't know if it is the novelty or whether they are right that a screen will draw their attention, but that seems to work.

Another thing that just comes out of the initiative of flight attendants is that I notice a lot of flight attendants will ask passengers to pay attention. They will actually go to the passenger and ask them to pay attention or to stop talking, and will ask the people around their immediate area to pay attention, and that seems to also work.

Other than that, there is apathy with passengers. They use their time when they come onboard to flip through the magazines or read the newspapers, and it is a problem. It is one of the things that in the past we have seen has allowed a passenger to survive, by knowing where the exits are, by knowing the information that the flight attendants give them, but it is a problem to have passengers pay attention to your announcements.

Mr. LEVITAS. On the lifevest problem that we are all familiar with, you made reference to the need for standardization. It is my experience that there is not only differences from carrier to carrier, but also within the same airline there are different lifevests. Is that your experiences as well?

Ms. SAITO. Yes; that is true.

Mr. LEVITAS. In fact, I have even seen on the same aircraft under adjoining seats different types of lifevests. Is that also true?

Ms. SAITO. Yes; that is true.

Mr. LEVITAS. That being the case, what is the significance of the demonstration being given by the flight attendant as to how to use the lifevest, since they are all different in terms of the way you use them, if you might be getting a different lifevest when you reach under your seat?

Ms. SAITO. We agree that it makes part of your announcement just false, and that is why we say we need all carriers to carry the same lifevests, not just one carrier carry the same, but all of them, to have one standardized lifevest for the United States.

Mr. LEVITAS. We had some hearings before this subcommittee several years ago, in part involving the question of lifevests, and two members of this subcommittee received instructions on how to put on the lifevest, in a lighted room, not smoke filled, not under emergency conditions, and I will be presumptuous enough to say that they were reasonably intelligent people. Others would dispute that, but I will just make that statement. Certainly they had flown in aircraft before. The result of that was after a long time, at the end they never got the lifevests on correctly. Now that tells me that we have got a real serious problem here, both in terms of standardization and instruction for the average airline passenger. What do you think about that?

Ms. SAITO. I think that that was a real valuable exercise, and it is something that could be used for us in our test, to highlight the need to have practical experience, because even when you do go through the practice, you realize, too, the complexity that is involved in getting yourself ready for a crash, imminent crash, and as you say, it was a situation where you were in a very calm area. You knew your life was not at stake, and you still could not perform the task.

Mr. LEVITAS. Ms. Saito, let me say this—oh, sorry, Mr. McEwen, I apologize. Before I conclude, let me recognize my good friend from Ohio, Mr. McEwen.

Mr. MCEWEN. Thank you, Mr. Chairman. I certainly appreciate your line of questioning. I only have two quick questions for my own edification. The emergency training procedures and safety training programs by the various carriers, are those certified or approved by the FAA in any way?

Ms. SAITO. Yes. They have to be approved by the FAA.

Mr. McEwen. And yet there is still a divergence between the various carrier programs.

Ms. Saito. Yes.

Mr. McEwen. There is no standardization and recommendation from FAA——

Ms. Saito. No.

Mr. McEwen [continuing]. Concerning those?

Ms. Saito. No; there is not.

Mr. McEwen. In discussions of matters such as we are considering during this hearing, it is always raised whether or not the FAA should permit lighting and burning of materials in an enclosed oxygenated, pressurized cabin. Do you have any concerns that you would like to share on that question?

Ms. Saito. Regarding banning smoking onboard?

Mr. McEwen. Yes.

Ms. Saito. We have advocated that they ban smoking on flights that are of short duration, about an hour, or on smaller aircraft, but we do have a problem with endorsing the ban of smoking on all flights. Cross-country flights are our main concern, and because we represent flight attendants, our position is that flight attendants will not be able to endorse this regulation, that we will see more assaults on our flight attendants, that we will see more abusive behavior, and that there will be an increase of smoking in the bathrooms.

Mr. McEwen. Thank you very much, Mr. Chairman.

Mr. Levitas. It is my understanding that FAA uses its flight operations group to check on the training and certification of flight attendant training programs, and flight attendants in their performance onboard; is that correct?

Ms. Saito. Yes.

Mr. Levitas. Do you know whether or not these flight operation inspectors actually themselves participate in flight attendant training programs?

Ms. Saito. I have never seen any.

Mr. Levitas. Let me just summarize my own reaction to your excellent testimony, and I hope that a lot of people pay some attention to what you have said here today.

If we start off with the assumption, which I do, that flight attendants are critical to the safety of the traveling public, that the present situation in terms of training, in terms of the seriousness with which FAA treats this aspect of flight operations, in terms of procedures, equipment, the various aspects that you have described in your testimony, we are doing a terrible job as far as giving flight attendants the training and the facilities and the opportunities to help protect the flying public. And that a lot of what we see and believe is really providing us safety protection is nothing more than cosmetics and that a lot more people could survive accidents if flight attendants received the support they need from their carriers, and if the regulations that FAA established, both for training and for cabin safety were significantly increased.

That is just the conclusion I come to listening to your testimony, and hearing the responses you have given to the questions from members of this subcommittee. I would like to thank you for being here today, Ms. Saito.

Ms. Saito. Thank you. It is my pleasure.

Mr. Levitas. We appreciate the contribution you and other flight attendants make to the traveling public. Thank you.

Ms. Saito. Thank you.

Mr. Levitas. The next witness is Mr. Harold Schaitberger, legislative director, International Association of Fire Fighters, who is accompanied today by Richard M. Duffy, occupational safety and health coordinator.

Gentlemen, if you will come forward. We appreciate your being here today and look forward to your testimony.

TESTIMONY OF HAROLD A. SCHAITBERGER, LEGISLATIVE DIRECTOR, INTERNATIONAL ASSOCIATION OF FIRE FIGHTERS, AFL-CIO-CLC, ACCOMPANIED BY RICHARD M. DUFFY, OCCUPATIONAL SAFETY AND HEALTH COORDINATOR, IAFF

Mr. Schaitberger. Thank you, Mr. Chairman, and members of the committee.

On behalf of the membership of the International Association of Fire Fighters, AFL-CIO-CLC, representing 175,000 professional firefighters throughout the United States, we would like to take this opportunity to thank the committee for providing us with this opportunity to present our views concerning the issue of aircraft fire safety. To underline the thrust of our comments, we are most concerned why the Federal Aviation Administration has been unwilling to take action to further enhance aircraft safety regulations in the following areas: aircraft interiors, smoke/fire detection system, crash/rescue manpower, firefighter protective clothing, firefighter respiratory protection, aircraft cabin extinguishing agents.

While public attention has been recently focused on the aircraft fire problem as a result of the recent Air Canada tragedy and other smaller incidents reported in the media, the problem is not a new one. Ten years ago, in 1973, a Boeing 707 aircraft made an emergency landing in Paris, France, after a fire in a plastic waste basket near the lavatory was discovered. Despite a successful landing, some 124 people died from inhaling toxic fumes and byproducts given off by the burning materials used in the aircraft interior.

This represents one of the most severe problems involved in aircraft fires—that is, injuries and deaths due to the toxic gases and smoke that result from burning cabin interiors, including seats, interior panels, carpeting, insulation, and carry-on baggage. This is highlighted by the fact that 80 percent of all deaths during an aircraft fire result from toxic gas and smoke inhalation—and not burns.

It should be noted that the seats, alone, account for a large amount of the combustible material on an aircraft. In a 300-seat aircraft, they account for 2,400 pounds of potentially combustible materials. Use of less flammable and fire-resistant seating materials would go a long way in reducing deaths attributed to toxic fumes and gases. Such materials are available today, and have been available for some time, yet the FAA has only last week announced its intention to promulgate standards which would require the use of seat-blocking material in cabin interiors in the future.

We feel it is by no coincidence that the announcement made by FAA Administrator Lynn Helms was made shortly following the Air Canada tragedy and following a recent press conference held by our international union, charging the FAA of failing to move effectively and delaying needed standards and improvements for too long. Although this standard may be adopted in July, FAA pointed out that retrofitting current aircraft will take up to 3 years to satisfy the new regulation.

In testimony before the House Science and Technology Committee on Monday, June 27, 1983, FAA Administrator Helms announced the intention to implement such a standard for seat blocking. However, immediately following Administrator Helms' testimony, NASA officials testified that technology for other interior configurations has been concluded for new carpeting materials and configurations are available for use in today's market. However, the FAA has not indicated any intention to require standards in this area.

The committee should realize that the materials used for aircraft interiors include ABS, polycarbonate, polyethylene, polypropylene, polystyrene, polyurethane, and polyvinylchloride, all of which break down to give off various toxic chemicals when burning begins. These chemicals are given off as fumes which may be odorless and colorless and can be dangerous in very minute quantities. It should be realized that these toxic fumes begin to be given off long before the materials actually catch fire and burst into flames.

I would like just for a second to underline that, Mr. Chairman. This morning, Mr. Grubbs mentioned, and was asked about, when he detected any type of odor or smell. Many of these materials give off very dangerous and deadly fumes, again odorless and colorless, which can begin to do its damage long before it would ever be detectable by the human senses.

The IAFF believes that technology has been available and that sufficient research, which has been conducted as far back as the 1967 Apollo tragedy, has been conducted. Standards should be implemented immediately, requiring more fire-resistant and fire-retardant materials in interiors of aircraft.

Another area of great concern to our international union is that current FAA regulations do not require fire or smoke detectors in aircraft cabins, lavatories, or galley areas. In light of the great speed with which aircraft fires spread, and with which heat and fumes intensify, early detection and warning of fire provide precious time—time that is absolutely crucial for preventing loss of life.

It is interesting to note that in today's society many governments require the use of smoke detectors in the building of commercial structures, and many municipalities even require contractors to provide smoke detectors in residential homes. Yet the FAA still does not require the use of smoke detectors in multimillion dollar aircraft, carrying hundreds of people at a time. Recently, Administrator Helms testified, in answer to a question concerning smoke detectors, that the FAA was more interested in preventing fires and did not want to chance panicking people on board aircraft with detection devices.

This seems absurd to us, since there are so many smoke and fire detection systems which do not give off audible or visual alarms to the general public, but can alert the cabin crew or cockpit crew to a fire situation and its location long before it would be detectable by the passengers. An annunciator system would not alarm the passengers but would alert the crew, again, providing valuable time which is needed in order to prevent loss of life and injuries. The question as to whether these systems are now available has already been answered, since a few new Boeing aircraft have installed fire and smoke detectors in lavatories on their own initiative.

The FAA has been notified of the need for improved smoke and fire detection for quite some time. This recommendation can be found as early as 1976 in the FAA's Air Carrier Cabin Safety Survey. Additionally, the National Transportation Safety Board has recommended improved detection to the FAA as early as 1973. In light of all these facts, the FAA's failure to require fire and smoke detectors in cabin areas and/or galley and lavatories is incomprehensible and borders on negligence.

While the FAA begins its slow movement in issuing regulations to enhance the fire safety of aircraft interiors, it is also considering taking action that could further jeopardize the safety of aircraft passengers during an emergency situation. FAA part 139 sets out airport certification standards for assuring safety in air transportation, including the operation and maintenance of adequate fire fighting and rescue equipment. These standards are a bare minimum falling far below requirements for fire safety established by the National Fire Protection Association and the International Civilian Aviation Organization, NFPA and ICAO.

The FAA, considering that changes in part 139 might be necessary, contracted with HH Aerospace Design Co. to develop a suggested method of improving airport certification standards in the most cost-effective way. The HH study, among its recommendations, made two that we take strong issue with. They are: One, the elimination of emergency equipment requirements at index A, AA, and B airports; and two, no provision of protection for commuter airports. These recommendations to eliminate crash/fire/rescue are in complete conflict with ICAO and NFPA standards, which have been accepted by all internationally recognized experts in the field.

There are several basic problems with the HH study recommendations, deriving from inappropriate data selection and inappropriate assumptions. Two of them are: One, the study was limited exclusively to U.S. aviation activities. A worldwide point of view would have been more realistic in light of the fact that in many cases accidents outside the United States involve American aircraft, personnel and passengers. Two of the 628 accidents studied, 1966 to 1978, 221 were estimated to involve actual or potential crash injury or death by impact or fire. Excluding midair crashes, 16.5 percent of the 221 accidents occurred at A, AA, and B airports—the very airports where elimination of crash/fire/rescue is being recommended. The HH study discounted 406 of the 628 accidents as having no crash/fire/rescue benefit. It is hard to understand what criteria were used in this decision. However, after careful study, it becomes evident that the presence of an actual fire was the principal factor considered.

Contrary to its original purpose, the HH study was focused on cost-benefit alone, thus inferring that crash/fire/rescue was a burden on the airport operator. The contractor based cost analyses on manpower and equipment that is presently available at airports and not that is actually required by part 139. The estimated cost was based on data obtained at a few selected airports which were not listed, and the data was not substantiated.

It must be emphasized that the only costs required for comparison purposes, for changes in part 139, are the costs involved in providing services that are actually required by the regulation. All extra equipment is provided as a result of local assessment of risk and at the airport manager's discretion. By using the contractor's hypothetical figures, costs have been highly inflated. It should also be noted that manpower at many A and AA airports in the southern region are used for other purposes, and would be employed whether or not crash/fire/rescue would be required—a fact mentioned only briefly by the study.

Additionally, the study bases its figures on enplaned passengers. This really has no meaning, since it does not account for protection for through-passengers—that is, everyone at risk. For example, an aircraft boarding 10 passengers may have 60 other through-passengers already onboard. Most A, AA, and even B airports are intermediate stops between large and medium hubs. The average seating capacity of CV-580 aircraft is 45 to 50; seating capacity of a B-737 is 80-plus; and for the DC-9, it is 90-plus. These aircraft frequently use the A, AA, and B airports. Using the lowest movement factor of 4 flights a day at A and AA airports, and 7.6 flights at B airports, the cost of protection per passenger seat is amazingly low compared with the study's report.

Most importantly, and finally, it is well documented that 80 percent of all accidents occur on the runway or within the overrun areas. It is essential that the rescue vehicles be so located as to ensure minimum response time to this critical area. This can only be done if a crash/fire/rescue presence is maintained at the airport. In an accident, the occupants are usually trapped and many would never be able to evacuate the aircraft without immediate outside assistance.

Time is the firefighter's worst enemy. In structural firefighting, response time is usually measured in a matter of minutes. Airport response time must be measured in a matter of seconds. When considering the statistics that 80 percent of all accidents occur on the runway or within 3,000 feet of the threshold, any consideration which would eliminate a crash/fire/rescue presence at any airport where regularly scheduled passenger service is available would be ill-conceived and an unnecessary danger for the traveling public.

We are providing to the committee a sample list of the airports which could be affected by the study recommendations. But the chairman may also be interested that in your home State, the airports at Albany, Columbus, Fort Benning, Macon, Marietta, Valdosta, would be affected by this regulation if it were to be implemented.

Providing adequate fire/crash/rescue equipment and personnel is not the only need which exists in our airport system today, and which the FAA has been negligent in. Firefighting and rescue efforts in the interior of aircraft are severely limited due to the smoke and toxic byproducts of combustion produced by the burning of interior materials, which we have just discussed. Two additional problems which hamper the ability of fire rescue personnel from conducting effective rescue operations are the lack of FAA standards in providing adequate firefighting protective clothing and self-contained breathing apparatus.

The theory behind firefighter protective equipment is to provide a protective barrier between the firefighter and the environmental extremes of heat, cold, steam, water, and toxic substances to which we are continuously exposed. While the Occupational Safety and Health Administration, OSHA, has promulgated regulations utilized by industrial fire brigades and municipal fire departments for body, head and face, hand and foot protection, the FAA only recommends in general terms the type of protective clothing that should be worn by airport firefighters. The detailed OSHA regulations were based on performance standards developed by the National Fire Protection Association, the National Institute for Occupational Safety and Health, and the U.S. Fire Administration.

Since aircraft crash rescue personnel protective coats, pants, gloves, and hoods are not standardized, varying degrees of protection are afforded firefighters, depending upon which airport they service. Current FAA recommendations, FAA AC 150/5210, for protective clothing, are completely inadequate and obsolete. FAA does not have any performance criteria by which to measure the effectiveness of the garments. Although FAA describes an approach garment—three-layer approach—they mistakenly utilize the term proximity. They also still recommend clothing fabrics that have shown to be deficient in the fire environment.

Structural and other inferior protective garments or even proximity garments are useless for aircraft rescue since a burning airplane cannot be approached without severe risk to firefighters unless properly designed approach garments are required. Many current protective garments are made of aluminized asbestos, which can pose a cancer risk to the firefighters, even though safer materials are now readily available, such as aluminized kevlar.

One additional problem is that most aircraft firefighter protective clothing is not even designed to interface properly with self-contained breathing apparatus which, again, reduces the firefighter's capability and ability to perform rescue operations.

If I could, I would like to have one of our staff members come forth, so that the committee can see what type of equipment and proximity garments are available on the market. If you want to just—if you would face this way.

The most important points—Rich, if you want to come up, too—again, we are trying to protect the firefighter from any possible exposure to the fire environment. And so you have an overlapping system of protective material which rises up to the chest area. You have a liner, kevlar, with an aluminized covering. And the coat, gloves and hood, with a gold shield, will allow this individual to make an approach in a fire situation which otherwise would just not be possible.

But there is still a problem, because the FAA doesn't require self-contained breathing apparatus for firefighters. Even though this is some of the most modern equipment available today, it does not provide the capability to interface with self-contained breathing apparatus.

It was mentioned earlier by Congressman Rowland whether or not firefighters or any outside help tried to make a rescue attempt. First of all, our information is that, in fact, the crash firefighters approached from the right side of the aircraft; the structural firefighters approached from the other side, I believe the galley area. They were not afforded the kind of equipment we are talking about today, particularly the interface with self-contained breathing apparatus and this type of garment. And, thus, even though they attempted to make the approach, they were forced back. They could not make an entry. They were just forced back by the heat, flames, and smoke.

This equipment, this self-contained breathing apparatus, is a piece that we have worked with, the company and NASA, in developing, which is some of the best available on the market. This piece of apparatus will allow a firefighter to enter a smoke- or toxic-filled area and operate. The problem is, there is no way that this piece of apparatus can be used with the proximity suit or approach garment because it is not required. Therefore, even the industry is not inclined to develop a pouch which is easily adaptable in order to cover a self-contained breath apparatus.

Mr. LEVITAS. Will you hold up the breathing device?

Mr. DUFFY. Sure.

I can expand on this. It was developed through NASA in the early seventies, basically after the Manned Space Flight Center became involved with fire materials after the 1967 Apollo problem where three astronauts did die. There it is a lighter weight unit. It was approximately 24 pounds filled with air, compared to a 35-pound limit, and has a 30-minute rated service life. Under normal conditions, you would get 30 minutes of air. Under other times, you would probably get 20 minutes' worth of air out of the unit.

This is one of the better units on the market. Again, there are ones that will give you longer duration. You can get 1 hour rated air supply out of it, No. 1. No. 2, you can go to a closed-circuit unit that you can get up to 4 hours' breathing time.

Mr. MOLINARI. Would that be such that it would only be used with smoke, or could you actually go through fire with that?

Mr. DUFFY. No. This is an approach suit, which means you can get within a few yards of a high-rated fire with a temperature of 1,500 to 2,000 degrees, an extremely high rating heat load. You can't walk through fire with it. It is not an entry suit. It is an approach suit. But it is typical of the suit worn in many fire departments now and airports.

It is constructed of better materials. It is not constructed of asbestos. There is a stigma attached, in my opinion, of a uniform made out of asbestos; knowing when the uniform can't be worn more, he can't throw it in the garbage, he has to go to a hazardous waste suit.

Mr. **Molinari**. How about in the fire; would he have been able to go into the fire?

Mr. **Duffy**. Certainly not.

Mr. **Molinari**. How about the piece of equipment you have in your hand? The blunt question is really, could that have been used going into a fire?

Mr. **Schaitberger**. It depends on the state of the fire. Having ridden the rigs for 12 years myself, we are really talking about at what stage of the fire you are at. I, myself, like all fire fighters, have entered into environmental situations where you could not exist, heat-wise, and particularly breathing, without this equipment.

When you mentioned the aircraft specifically, it depends on what stage. If you notice in the film at the point where flashover occurred, and you have a completely involved cabin, boiling out of the doors, it is at that point impossible to make any kind of an entry. Prior to that point, though, and until you have that flashover, this kind of equipment and apparatus will allow you to make entry into a smoke-filled and heat-filled environment.

So I am just trying to say, it depends on at what stage of the fire we are talking about, whether it is fully involved or whether or not it is at a stage, as described by Mr. Grubbs earlier, where it was beginning to press down and just prior to it receiving enough oxygen to do a flashover.

Mr. **Molinari**. But how do you know when you enter a plane when a flashover is going to occur?

Mr. **Schaitberger**. Sometimes you don't know. I have been caught in flashovers. Hopefully, through your training you recognize the signs—how much heat has been generated; is it an enclosed area that is beginning to puff. A lot of time you can see smoke begin to puff out of small openings; whether it be a structural fire or aircraft cabin doesn't make any difference. If you see that kind of a presence, then you recognize here is a situation that is waiting for some air to enter which then could flashover. But it is a judgment, and something that you gain with experience and training.

I essentially have just taken a look at the breathing apparatus.

Mr. **Levitas**. Excuse me, Mr. Schaitberger. There is a vote going on the floor at this moment, and these are the second bells of that vote. So we are going to have to take a brief recess so we can go and be recorded. And then we will return to hear the completion of your testimony and ask questions.

The subcommittee will stand in recess.

[Recess.]

Mr. **Levitas**. The subcommittee will please come to order.

Mr. Schaitberger, if you will continue.

Mr. **Schaitberger**. Thank you, Mr. Chairman.

We had just had an opportunity to show you the self-contained breathing apparatus and bring to your attention the lack of requirement by the FAA to provide this type of equipment for fire personnel.

Another area which the IAFF believes should be thoroughly discussed and in which more research is needed is the question of appropriate portable fire extinguishing systems for aircraft cabin use. Today, there are four common types of hand-held fire extinguishers found aboard aircraft: CO_2, dry chemical, H_2O—water—and halogenated extinguishing agents, commonly known as halon 1211, 1301, and various other types.

We believe that there are problems associated with each of these extinguishing materials. For example, CO_2 is not a particularly effective agent in limited supply against class A fires. Class A fires would be those fires involving normal combustible materials, such as paper towels, clothing, cloth, et cetera. Certain dry chemicals are effective extinguishing agents for all classes of fire, but we believe that they may interfere with electronic circuitry, as well as visibility. This could be of particular concern to the cockpit crew in an aircraft.

Halon 1211, bromo-chloride-fluoromethane, is effective at extinguishing all classes of fire, but when heated, it, in itself, decomposes into toxic chemicals like hydrogen chloride, free chlorine, hydrogen fluoride, hydrogen bromide, and free bromide. Halon 1211, when used in a confined area, has been shown to cause, to humans, central nervous system effects, including tremors, convulsions, and unconsciousness; and cardiovascular effects, including hypertension, decreased heart rate, and occasional cardiac arrythmias. It can also be lethal.

This is highlighted by a death of a fire fighter on a military installation outside of Tucson, AZ in October 1981. Halon 1211 was the extinguishing agent being used. Although still in litigation, it appears that the toxic byproducts from the halon created from its exposure to heat, gathered under the hood of the proximity suit worn by the firefighter. We are, therefore, quite concerned as to the situation which could be created by the use of halon extinguishing agents in confined areas, such as lavatories or galleys, by crew members or other individuals.

Additionally, we feel that flight crews for many airlines are never given the opportunity to receive sufficient onhands training—and that certainly was covered quite thoroughly by Ms. Saito. I would underline this by saying that we agree with the flight attendants that they should be provided training in a more realistic situation similar to the type of training that is typically provided to fire fighting personnel, and that is placing you in an environment which best resembles the type of environment that you will be faced with in an emergency situation.

In closing, the IAFF strongly feels that the Federal Aviation Administration has been reviewing these areas and materials, which can reduce toxicity, flammability, and add to the ability to perform successful rescue operations since the early 1970's. Years of neglect have gone by with little action from the FAA. Their recent announcements are too little, too late. It is time for our elected representatives in Congress to demand the FAA take further action to improve aircraft fire safety.

With that, I would like to thank you again for the opportunity of being able to present our testimony today. We would be glad to try to answer any questions you may have.

[The prepared statement of Mr. Schaitberger follows:]

PREPARED STATEMENT OF HAROLD A. SCHAITBERGER

On behalf of the membership of the International Association of Fire Fighters (IAFF), AFL–CIO–CLC, representing 175,000 professional fire fighters throughout the United States, we would like to take this opportunity to thank the Committee for providing us with this opportunity to present our views concerning the issue of aircraft fire safety. To underline the trust of our comments, we are most concerned why the Federal Aviation Administration (FAA) has been unwilling to take action to further enhance aircraft safety regulations in the following areas: aircraft interiors, smoke/fire detection systems, crash/rescue manpower, fire fighter protective clothing, fire fighter respitory protection, aircraft cabin extinguishing agents.

While public attention has been recently focused on the aircraft fire problem as a result of the recent Air Canada tragedy and other smaller incidents reported in the media, the problem is not a new one. Ten years ago in 1973, a Boeing 707 aircraft made an emergency landing in Paris, France after a fire in a plastic waste basket near the lavatory was discovered. Despite a successful landing, some 124 people died from inhaling toxic fumes and byproducts given off by the burning materials used in the aircraft interior. This represents one of the most severe problems involved in aircraft fires—that is, injuries and deaths due to the toxic gases and smoke that result from burning cabin interiors, including seats, interior panels, carpeting, insulation, and carry-on baggage. This is highlighted by the fact that 80 percent of all deaths during an aircraft fire result from toxic gas and smoke inhalation, and not burns.

It should be noted that the seats, alone account for a large amount of the combustible material on an aircraft. In a 300-seat aircraft, they account for 2400 pounds of potentially combustible materials. Use of less flammable and fire-resistant seating materials would go a long way in reducing deaths attributed to fumes and gases. Such materials are available today, and have been available for some time, yet the FAA has only last week announced its intention to promulgate standards which would require the use of seat-blocking material in cabin interiors in the future.

We feel it is by no coincidence that the announcement made by FAA Administrator Lynn Helms was made shortly following the Air Canada tragedy and following a recent press conference held by our International Union, charging the FAA of failing to move effectively and delaying needed standards and improvements for too long. Although this standard may be adopted in July, FAA pointed out that retrofitting current aircraft will take up to three years to satisfy the new regulation.

In testimony before the House Science & Technology Committee on Monday, June 27, 1983, FAA Administrator Helms announced the intention to implement such a standard for seat-blocking. However, immediately following Administrator Helms' testimony, NASA officials testified that technology for other interior configurations has been concluded for new carpeting materials and configurations are available for us in today's market. However, the FAA has not indicated any intention to require standards in this area.

The Committee should realize that the materials used for aircraft interiors include ABS (acrylonitrile butadiene styrene), polycarbonate, polyethylene, polypropylene, poystyrene, polyurethane and polyvinylchloride, all of which break down to give off various toxic chemicals when burning begins. These chemicals are given off as fumes which may be odorless and colorless and can be dangerous in very minute quantities. It should be realized that these toxic fumes begin to be given off long before the materials actually catch fire and burst into flames.

The IAFF believes that technology has been available and that sufficient research, which has been conducted as far back as the 1967 Apollo tragedy, has been conducted. Standards should be implemented immediately, requiring more fire resistant and fire-retardent materials in interiors of aircraft.

Another area of great concern to our International Union, is that current FAA regulations do not require fire or smoke detectors in aircraft cabins, lavatories or galley areas. In light of the great speed with which aircraft fires spread, and with which heat and fumes intenisfy, early detection and warning of fire provide precious time, time that is absolutely crucial for preventing loss of life.

It is interesting to note that in today's society many governments require the use of smoke detectors in the building of commercial structures, and many municipalities even require contractors to provide smoke detectors in residential homes. Yet the FAA still does not require the use of smoke detectors in multi-million dollar aircraft, carrying hundreds of people at a time. Recently, Administrator Helms testified in answer to a question concerning smoke detectors, that the FAA was more interested in preventing fires and did not want to chance panicking people on board aircraft with detection devices.

This seems absurd to us, since there are so many smoke and fire detection systems which do not give off audible or visual alarms to the general public, but can alert the cabin crew or cockpit crew to a fire situation and its location long before it would be detectable by the passengers. An annunciator system would not alarm the passengers but would alert the crew, again, providing valuable time which is needed in order to prevent loss of life and injuries. The question as to whether these systems are now available has already been answered, since a few new Boeing aircraft have installed fire and smoke detectors in lavatories on their own initiative.

The FAA has been notified of the need for improved smoke and fire detection. This recommendation can be found as early as 1976 in the FAA's Air Carrier Cabin Safety Survey. Additional, the National Transportation Safety Board has recommended improved detection to the FAA as early as 1973. In light of all these facts, the FAA's failure to require fire and smoke detectors in cabin areas and/or galley and lavatories is incomprehensible and borders on negligence.

While the FAA begins its slow movement in issuing regulations to enhance the fire safety of aircraft interiors, it is also considering taking action that could further jeopardize the safety of aircraft passengers during an emergency situation. FAA Part 139 sets out airport certification standards for assuring safety in air transportation, including the operation and maintenance of adequate fire fighting and rescue equipment. These standards are a bare minimum falling far below requirements for fire safety established by the National Fire Protection Association (NFPA) and the International Civilian Aviation Organization (ICAO).

The FAA, considering that changes in Part 139 might be necessary, contracted with HH Aerospace Design Company to develop a suggested method of improving airport certification standards in the most cost-effective way. The HH Study, among its recommendations, made two that we take strong issue with. They are: (1) the elimination of emergency equipment requirements at Index A, AA and B airports, and (2) no provision of protection for commuter airports. These recommendations to eliminate crash/fire/rescue are in complete conflict with ICAO and NFPA standards, which have been accepted by all internationally recognized experts in the field.

There are several basic problems with the HH Study recommendations, deriving from inappropriate data selection and inappropriate assumptions. Two of them are:

(1) The Study was limited exclusively to U.S. aviation activities. A worlwide point of view would have been more realistic in light of the fact that in many cases accidents outside the U.S. involve American aircraft, personnel and passengers.

(2) Of the 628 accidents studied (1966–78), 221 were estimated to involve actual or potential crash injury or death by impact or fire. Excluding mid-air crashes, 16.5 percent of the 221 accidents occurred at A, AA and B airports—the very airports where elimination of crash/fire/rescue is being recommended. The HH Study discounted 406 of the 628 accidents as having no crash/fire/rescue benefit. It is hard to understand what criteria were used in this decision. However, after careful study, it becomes evident that the presence of an actual fire was the principal factor considered.

Contrary to its original purpose, the HH Study was focused on cost benefit alone, thus inferring that crash/fire/rescue was a burden on the airport operator. The contractor based cost analyses on manpower and equipment that is presently available at airports and not that is actually required by Part 139. The estimated cost was based on data obtained at a few selected airports which were not listed, and the data was not substantiated. It must be emphasized that the only costs required for comparison purposes, for changes in Part 139, are the costs involved in providing services that are actually required by the regulation. All extra equipment is provided as a result of local assessment of risk and at the airport manager's discretion. By using the contractor's hypothetical figures, costs have been highly inflated. It should also be noted that manpower at many A and AA airports in the southern region are used for other purposes, and would be employed whether or not crash/fire/rescue would be required—a fact mentioned only briefly by the Study.

Additionally, the Study bases its figures on enplaned passengers. This really has no meaning, since it does not account for protection for through-passengers—that is, everyone at risk. For example, an aircraft boarding 10 passengers may have 60 other through-passengers already on board. Most A, AA and even B airports are intermediate stops between large and medium hubs. The average seating capacity of CV 580 aircraft is 45 to 50, seating capacity of a B 737 is 80-plus, and for the DC 9 it is 90-plus. These aircraft frequently use the A, AA and B airports. Using the lowest movement factor of 4 flights a day at A and AA airports, and 7.6 flights at B airports, the cost of protection per passenger seat is amazingly low compared with the Study's report.

Most importantly, and finally, it is well documented that 80 percent of all accidents occur on the runway or within the overrun areas. It is essential that the rescue vehicles be so located as to insure minimum response time to this critical area. This can only be done if a crash/fire/rescue presence is maintained at the airport. In an accident the occupants are usually trapped and many would never be able to evacuate the aircraft without immediate outside assistance. Time is the fire fighter's worst enemy. In structural fire fighting, response time is usually measured in a matter of minutes. Airport response time must be measured in a matter of seconds. When considering the statistics that 80 percent of all accidents occur on the runway or within 3000 feet of the threshold, any consideration which would eliminate a crash/fire/rescue presence at any airport where regularly scheduled passenger service is available, would be ill-conceived and an unnecessary danger for the traveling public.

We are providing to the committee a sample list of the airports which could be affected by the Study recommendations.

Providing adequate fire crash rescue equipment and personnel is not the only need which exists in our airport system today, and which the FAA has been negligent in. Fire fighting and rescue efforts in the interior of aircraft are severely limited due to the smoke and toxic by-products of combustion produced by the burning of interior materials, which we've just discussed. Two additional problems which hamper the ability of fire rescue personnel from conducting effective rescue operations are the lack of FAA standards in providing adequate fire fighting protective clothing and self-contained breathing apparatus.

The theory behind fire fighter protective equipment is to provide a protective barrier between the fire fighter and the environmental extremes of heat, cold, steam, water and toxic substances to which we are continuously exposed. While the Occupational Safety and Health Administration (OSHA) has promulgated regulations utilized by industrial fire brigades and municipal fire departments for body, head and face, hand and foot protection, the FAA only recommends in general terms the type of protective clothing that should be worn by airport fire fighters. The detailed OSHA regulations were based on performance standards developed by the National Fire Protection Association, the National Institute for Occupational Safety and Health, and the U.S. Fire Administration.

Since aircraft crash rescue personnel protective coats, pants, gloves, and hoods are not standardized, varying degrees of protection are afforded fire fighters, depending upon which airport they service. Current FAA recommendations (FAA AC 150/5210) for protective clothing are completely inadequate and obsolete. FAA does not have any performance criteria by which to measure the effectiveness of the garments. Although FAA describes an approach garment (three layer approach), they mistakenly utilize the term proximity. They also still recommend clothing fabrics that have shown to be deficient in the fire environment.

Structural and other inferior protective garments or even proximity garments are useless for aircraft rescue since a burning airplane cannot be approached without severe risk to fire fighters unless properly designed approach garments are required. Many current protective garments are made of aluminized asbestos, which can pose a cancer risk to the fire fighters, even though safer materials are now readily available, such as aluminized kevlar.

One additional problem is that most aircraft fire fighter protective clothing is not even designed to interface properly with self-contained breathing apparatus which, again, reduces the fire fighter's capability and ability to perform rescue operations.

I would like to have one of our staff members come forth, so that the Committee can see what type of equipment and proximity garments are available on the market. Again, the importance of this garment is, one, to protect the fire fighter, but as or more important, it will allow a fire fighting crew to advance into an aircraft fire situation and conduct rescue operations which would otherwise be impossible.

I would also like to mention that one of the most important pieces of protective equipment for the fire fighter is the self-contained breathing apparatus used for respiratory protection. OSHA now has regulations requiring the use of self-contained breathing apparatus during all interior structural fire fighting operations, including suppression, rescue and overhaul. While OSHA has promulgated regulations utilized by industrial fire brigades and municipal fire departments requiring the use of positive pressure self-contained breathing apparatus, there are not FAA requirements for aircraft crash rescue personnel. FAA only recommends that breathing equipment, preferably of compressed air type, be furnished. Thus, self-contained breathing apparatus are not generally worn by aircraft fire fighters, and fire fighting and rescue efforts to the interior of the aircraft are severely limited.

Another area which the IAFF believes should be thoroughly discussed and in which more research is needed is the question of appropriate portable fire extinguishing systems for aircraft cabin use. Today, there are four common types of hand-held fire extinguishers found aboard aircraft: CO_2, dry chemical, H_2O (water), and halogenated extinguishing agents, (Halon 1211, 1301, etc.).

We believe that there are problems associated with each of these extinguishing materials. For example, CO_2 is not a particularly effective agent in limited supply against Class A fires. Class A fires would be those fires involving normal combustible materials, such as paper towels clothing, cloth, etc. Certain dry chemicals are effective extinguishing agents for all classes of fire, but we believe that they may interfere with electronic circuitry, as well as visibility. This could be of particular concern to the cockpit crew in an aircraft.

Halon 1211, bromo-chloride-fluoromethane, is effective at extinguishing all callses of fire, but when heated it, in itself, decomposes into toxic chemicals like hydrogen chloride, free chlorine, hydrogen fluoride, hydrogen bromide, and free bromide. Halon 1211, when used in a confined area, has been shown to cause, to humans, central nervous system effects, including tremors, convulsions and unconsciousness; and cardio-vascular effects, including hypertension, decreased heart rate, and occasional cardiac arrythmias. It can also be lethal.

This is highlighted by a death of a fire fighter on a military installation outside of Tucson, Arizona in October of 1981. Halon 1211 was the extinguishing agent being used. Although still in litigation, it appears that the toxic by-products from the halon created from its exposure to heat, gathered under the hood of the proximity suit worn by the fire fighter. We are, therefore, quite concerned as to the situation which could be created by the use of halon extinguishing agents in confined areas, such as lavatories or gallies, by crew members or other individuals.

Additionally, we feel that flight crews for many airlines are never given the opportunity to receive sufficient on-hands training in the use of portable fire extinguishers. In many instances, flight crews are only trained to use coffee and other liquid substances on board, to extinguish fires at the incipient stage. Providing flight crews with evolutionary-type training activities, in which they would be able to utilize the equipment available to them in fire emergency situations, would go a long way in increasing their capability to further assist the traveling public in the event an emergency arises.

In closing, the IAFF strongly feels that the Federal Aviation Administration has been reviewing these areas and materials, which can reduce toxicity, flammability, and add to the ability to perform successful rescue operations since the early 1970s. Years of neglect have gone by with little action from the FAA. Their recent announcements are too little, too late. It is time for our elected representatives in Congress to demand the FAA take further action to improve aircraft fire safety.

AIRPORTS AFFECTED

If the FAA were to consider and propose regulations to implement the HH Design Study recommendations 378 A, AA and B airports would be affected. Many now have CFR protection at the airport available.

Following is a sample list of some of those airports:

Official airport name	Associated city	State
Candle	Candle	Alaska.
Kodiak	Kodiak	Do.
Prudhoe Bay	Prudhoe Bay	Do.
Cedar Rapids Municipal	Cedar Rapids	Iowa.
Dubuque Municipal	Dubuque	Do.
Sioux City Municipal	Sioux City	Do.
Dodge City Municipal	Dodge City	Kansas.
Salina Municipal	Salina	Do.
Forbes Field	Topeka	Do.
Joplin Municipal	Joplin	Missouri.
Springfield Regional	Springfield	Do.
Scotts Bluff County	Scotts Bluff	Nebraska.
Greater Wilmington-New Castle County	Wilmington	Delaware.
Mercer County	Trenton	New Jersey.
Oneida County	Utica	New York.

Official airport name	Associated city	State
Westchester County	White Plains	Do.
Allentown-Bethlehem-Easton	Allentown	Pennsylvania.
Williamsport-Lycoming County	Williamsport	Do.
Danville Municipal	Danville	Virginia.
Lynchburg Municipal-Preston Glenn Field	Lynchburg	Do.
Roanoke Municipal/Woodrum	Roanoke	Do.
Kanawha	Charleston	Do.
Tri-State/Walker-Long Field	Huntington	West Virginia.
Decatur	Decatur	Illinois.
Greater Peoria	Peoria	Do.
Capital	Springfield	Do.
Michiana Regional	South Bend	Indiana.
Bishop	Flint	Michigan.
Kalamazoo Municipal	Kalamazoo	Do.
Oakland-Pontiac	Pontiac	Do.
Tri-City	Saginaw	Do.
Duluth International	Duluth	Minnesota.
Mansfield Lahm Municipal	Mansfield	Ohio.
Aberdeen Regional	Aberdeen	South Dakota.
Rapid City Regional	Rapid City	Do.
Nantucket Memorial	Nantucket	Massachusetts.
Worcester Municipal	Worcester	Do.
Burlington International	Burlington	Vermont.
Aspen-Pitkin County/Sardy Field	Aspen	Colorado.
Pueblo Memorial	Pueblo	Do.
Fanning Field	Idaho Falls	Idaho.
Bert Mooney	Butte	Montana.
Mahlon Sweet Field	Eugene	Oregon.
McNary Field	Salem	Do.
Ogden Municipal	Ogden	Utah.
Snohomish County/Paine Field	Everett	Washington.
Olympia	Olympia	Do.
Yakima Air Terminal	Yakima	Do.
Natrona County International	Casper	Wyoming.
Cheyenne	Cheyenne	Do.
Tuscaloosa Municipal	Tuscaloosa	Alabama.
Naples Municipal	Naples	Florida.
Vero Beach Municipal	Vero Beach	Do.
Albany-Dougherty County	Albany	Georgia.
Columbus Metropolitan	Columbus	Do.
Lewis B. Wilson	Macon	Do.
Barkley Regional	Paducah	Kentucky.
Gulfport-Biloxi Regional	Gulfport	Mississippi.
Fayetteville Municipal Grannis Field	Fayetteville	North Carolina.
Rocky Mount-Wilson	Rocky Mount	Do.
Smith Reynolds	Winston Salem	Do.
Florence City-County	Florence	South Carolina.
Tri-City	Bristol/Johnson/Kingsport	Tennessee.
Lafayette Regional	Lafayette	Louisiana.
Lake Charles Municipal	Lake Charles	Do.
Enid Woodring Municipal	Enid	Oklahoma.
Stillwater Municipal	Stillwater	Do.
Abilene Municipal	Abilene	Texas.
Laredo International	Laredo	Do.
Tyler Pounds Field	Tyler	Do.
Pulliam	Flagstaff	Arizona.
Yuma MCAS/Yuma International	Yuma	Do.
Meadows Field	Bakersfield	California.
Jack McNamara Field	Crescent City	Do.
Modesta City-County Harry Sham Field	Modesta	Do.
Santa Barbara Municipal	Santa Barbara	Do.
Santa Maria Public	Santa Maria	Do.
Elko Municipal J.C. Harris Field	Elko	Nevada.

Mr. Levitas. Am I correct, Mr. Schaitberger, that firefighters at airports are employees of the airport operator?

Mr. Schaitberger. There is a mixture. That is the case, but there are also many airports which are provided—which their firefighting service is provided by the municipality. They would have one of their stations of the municipality stationed at the airport. So it is a mixture of airport personnel and municipal firefighting personnel.

Mr. Levitas. At several points in your testimony you make the statement that there is a problem because FAA does not have proper requirements. For example, in the demonstration of the suit.

Mr. Schaitberger. Protective clothing, yes, sir.

Mr. Levitas. The protective clothing; several other examples that you gave.

You say there are not adequate FAA requirements. Why does it take the FAA to issue rules in this regard for something to be done as opposed to the municipality or the airport operator wanting to do the best they can in terms of providing firefighting capability?

Mr. Schaitberger. Well, I think that you would have to, first of all, make these judgments on an airport by airport—by each airport facility. I think it would be safe to say that for those departments which are municipal departments, that personnel would tend to be provided more adequate and proper firefighting protective clothing and equipment. Those firefighters which are employees of the airport would tend not to have available to them that equipment, and we believe it is strictly an economical consideration by the airport operator. It comes down to dollars and cents.

As far as the FAA regulations are concerned, you could really wear a burlap bag. If I am the airport operator and I want to provide burlap bags for my firefighting, fire/crash/rescue personnel, I could do that under FAA regulations because it only says that they should provide adequate—with no description of what is adequate or is not.

Mr. Levitas. I guess it is also true that many airport operators or municipalities, for that matter, tend to look to the FAA to provide the standard of performance, and that they take it that the FAA is doing its job properly and, therefore, would be specifying. That is the first thing.

The second thing, in the case of the protective clothing, for example, FAA requires something; then you automatically create a market for it. If you don't have that FAA requirement, then there isn't a large enough market to make it commercially feasible for a manufacturer to produce that type of protective clothing.

Is that also a factor?

Mr. Schaitberger. The second point I don't think would be true, Mr. Chairman. Your first point, I do believe many airport operators do look toward the FAA for guidelines and standards. The individual airports themselves certainly do not have the capability to provide their own research, their own analysis to create these type of standards. They do look toward the Federal Government to do this and to set those standards.

As far as the commercial availability, there are enough municipal departments, there are enough Federal firefighting personnel at military installations which require and do have available to them this type of equipment where there is a commercial need, and the commercial establishment has it available and does provide it now.

Mr. LEVITAS. You mentioned the halon fire extinguisher, and as I understood what you said, under certain heat conditions or fire conditions, that the fire extinguishing substance itself becomes a toxic chemical; and particularly if used in a confined area.

Now, isn't the halon extinguisher used on board aircraft?

Mr. SCHAITBERGER. That is correct. In fact, that has been mentioned in testimony. And we are aware that it is available on some aircraft.

There is no question that it is a very effective extinguishing agent. The question we raise—and we think there is enough evidence to show concern—is that halon, under heat conditions, does in fact produce these byproducts and does in fact become dangerous in confined area situations.

I might let my associate, Mr. Duffy, if he would like to, just carry that a step further and maybe particularly as it pertains to the situation at Tucson.

Mr. DUFFY. Our particular concern with halon arose—in all the halogenated outlines, the other halon extinguishers—arose with the death of a firefighter at Davis Air Force Base outside of Tucson which occurred in October of 1981. He was a young man, 21 years old, in the military, an airman, was on a practice fire, not as an actual emergency but at a practice fire with nine of his—nine other firefighters. He was using a portable halon 1211 extinguisher. While using it and while in the motions of attempting to put out the practice fire, as we understand it, he felt chest pains, dropped the extinguisher, walked back, sacked out on an associated piece of fire equipment, and then died.

The autopsy was minimal, as we understand it now, in talking with toxicologists at the University of Arizona, but indicated that he had a pre-existing heart problem, enlarged heart. However, the autopsy also revealed evidence of pulmonary edema, which is indicative of inhalation of 1211, halon 1211, and its decomposition products.

It is also very consistent—the problems that occurred in Tucson were consistent with the problems found in an Air Force study, findings of an Air Force study done at the Wright Air Force Base in the seventies with portable halon fire extinguishers. It was ironic, when we looked at this particular event—and are still quite concerned about it—that is about all the information we have, but we are still trying to get more. The Air Force Safety Center, Headquarters, Tactical Air Command Safety Center, is now reinvestigating this case, as I was told yesterday afternoon by a chief out there. It is ironic, they put this to rest as a heart problem for a 21-year-old individual 2 years ago. Now it is surfacing again because of the associated problems with halon 1211. They are still using such a product without further investigation.

The ironic part is we were told by the GSA, requesting information about the particular product, the individual I spoke to told me GSA does not allow for any Government agency to purchase halon 1211 extinguishers because of the problem. So there are a lot of them being used and a lot of unanswered questions we are concerned about.

Breathing apparatus, again, are not worn. He created a confined space by leaning over, using a fire extinguisher, and the halon byproducts were able to come up into the hood in the suit you saw this morning creating a halo which may have led to this person's death.

Mr. ROWLAND. Was this one case the basis for the statement you made about the toxicity of the halon?

Mr. SCHAITBERGER. No. The National Fire Protection Association, in its technical committee reports, also acknowledged the fact that certain halon, certain halogenated extinguishing agents do have toxicity association with them, toxic byproducts associated with them.

Mr. ROWLAND. Enough to be fatal?

Mr. DUFFY. Definitely, yes.

Mr. ROWLAND. According to the report. You are not just basing what you said on the death of this man?

Mr. DUFFY. Oh, certainly not. There is established medical evidence of toxicity of both halon and its byproducts in use in conjunction with a fire. Oh, certainly we wouldn't base it on just one incident. Again, it is a concern. It is an excellent fire extinguishing agent. However, in a confined space it can be lethal.

Mr. ROWLAND. There were some other airmen apparently using this at the same time, also. Did I understand you to say that?

Mr. DUFFY. Yes. It is our understanding right now.

Mr. ROWLAND. There was no effect on those people?

Mr. SCHAITBERGER. We are not sure of the situation whether it was like a lot of training functions where you have a shift of individuals in an evolution training exercise, and one individual is actually—it is his turn in the barrel, so to speak, and he was actually performing the evolution with the other observing. We are not sure exactly what the situation was, or whether they all had actually performed the same function.

Mr. ROWLAND. Do you know if there are other instances of possible death caused by the inhalation of the byproducts of that halon?

Mr. DUFFY. Again, we are not sure. What we are doing is we are just raising a question we think needs investigation. Our concern in a press conference we had a number of weeks ago illustrated this particular individual's fate. The Air Force Safety Center is now reinvestigating this particular file. We find that quite interesting. I was told yesterday that 2 years ago when the event happened, they just figured it was a heart attack, casualty, and very little was done even though the autopsies indicated there was, for example, the pulmonary edema in the lung.

Mr. ROWLAND. Pulmonary edema could be caused by smoke, many causes.

Mr. DUFFY. Granted.

Mr. ROWLAND. Not necessarily just from that.

Thank you, Mr. Chairman.

Mr. LEVITAS. Thank you, Dr. Rowland.

Did I understand you to say that GSA does not permit the Government to purchase halon fire extinguishers?

Mr. DUFFY. Generally. And, again, this was just speaking to one individual here in Washington that told us. He was surprised because it was his understanding that portable halon extinguishing agents are not normally allowed to be purchased under GSA. You use halon in two instances. One is a portable and one is a fixed fire extinguishing agent.

A fixed system in a confined area—for example, it is used in many computer rooms, et cetera—when that goes off, it is limited to an amount of time the halon is actually discharged, an alarm, sounds go off to indicate to personnel around that halon is being discharged, et cetera. None of those controls are afforded to a portable extinguisher.

Mr. LEVITAS. The reason I am asking the question is, are there any FAA regulations which either sanction or prohibit a particular type of fire extinguisher, hand-held extinguisher onboard?

Mr. DUFFY. None that we are aware of. Again, we are just encouraging further investigation.

Mr. LEVITAS. Because it seems to me that if halon has these effects that you are describing, and hand-held halon fire extinguishers are used inside an aircraft, which is obviously a confined environment, and particularly, for example, if you were operating it in the galley area or in a lavatory, that it is the classic example of where it ought not to be used.

Mr. SCHAITBERGER. That is our concern. We don't know that to be the case. We suspect that in fact may be the case.

Mr. LEVITAS. Let me ask you this: Yesterday we heard testimony that at Cincinnati International Airport, that the firefighting equipment ran out of the extinguishing material, the foam. Were you surprised to hear that?

Mr. SCHAITBERGER. We were surprised to hear it this morning. Although we had discussed why it appeared that they were not knocking down the fire after some period of time, and that is realizing that there are several uses, first of all, for the foam. One of the most important uses is to provide a safe pathway to enable firefighters to approach the aircraft and to enable survivors to exit and escape. That is prior to trying to place any foam for use as an actual extinguishing agent. And to see the plane still burning, we were a little concerned.

The question is why that would happen, until we found out this morning that they, in fact, did run out of foam which would then explain it.

Mr. LEVITAS. But were you surprised to learn they ran out? I mean, we were told yesterday that at an airport of this particular size, they are required to maintain a supply of, I think, 5,000 gallons——

Mr. SCHAITBERGER. 5,000 gallons.

Mr. LEVITAS [continuing]. Gallons of foam.

Mr. SCHAITBERGER. And that is not 5,000 gallons of foam, but they have to have enough foam to provide 5,000 gallons of foam application.

Mr. LEVITAS. I have no idea what that means. Does that sound like an adequate quantity to you? Obviously, it was not adequate in the case of Cincinnati.

Mr. SCHAITBERGER. I might defer. I have never conducted an aircraft fire operation personally, myself.

Mr. DUFFY. Again, I am not certainly an expert in firefighting extinguishment using foam. The 5,000 gallons we believe that was talked about was foam application. Foam is mixed with water, a certain percentage—3 to 6 percent—using AFFF.

Is it adequate? Certainly, after hearing that they ran out of foam, it showed to us—we thought when we saw the filmclips and a lot of the video from the actual fire itself, that there was not adequate manpower. That was our first immediate concern. We were quite shocked to see flames still in the burning fuselage knowing how long it takes newspeople to get to the scene, et cetera. We saw people standing back and an actual fire going without any application of foam at all, and just with one water hoseline being applied to the fuselage.

Again, we thought there was not adequate manpower, and we heard this morning that they ran out of foam. It clearly pointed out to us that changes need to be made on the amount of foam available, because we watched the plane burn.

Did that contribute to any of the fatalities on the aircraft? I am sure that is something that has to be investigated, but it clearly shows there is a further need for investigation on the amount of foam kept at an airport.

And, again, remembering that it is only a very small percentage of the actual water—use 5,000 gallons of water, 3 percent of it is foam. That is the amount of foam that is available.

Mr. LEVITAS. Are firefighters trained to enter burning aircraft?

Mr. SCHAITBERGER. Yes, they are; as a matter of fact, another point I really should have made in my testimony about aircraft firefighters. And the suggestion by some that they may not be needed at certain airports, I have had the opportunity over the last several years to serve on a professional qualifications committee of the National Fire Protection Association. That committee has been responsible for developing standards, national standards, for qualification of firefighting. And there is a standard in itself set aside for airport firefighter personnel qualifications, and these are the unique qualifications that are needed and are provided in order to certify an individual as an airport firefighter—the uniqueness of extrication, entry, forcible entry, which you would not receive as a standard structural firefighter.

So the point is, particularly in the municipal departments, yes, the firefighers are provided with training, although there are many cases at the smaller airports—and, again, particularly where it would be airport operators employing the firefighters—where this standard or these standards may not be utilized or adopted.

And Mr. Duffy makes an excellent point. Again, FAA does not require the use of this or any similar standard; only that they should have personnel there that can operate the equipment.

Mr. LEVITAS. Have you ever heard of a firefighter at an airport entering a burning aircraft?

Mr. DUFFY. During training exercises or during an actual——

Mr. LEVITAS. No. No. In an actual situation.

Mr. SCHAITBERGER. I personally have not, although I know it has occurred. And, again, through my work with this committee, I know it has occurred.

Mr. LEVITAS. Could you try to locate for us and identify, supply the places, times, circumstances, where that might have occurred?

Mr. SCHAITBERGER. Certainly.

Mr. LEVITAS. Are you aware of any training program to deal with in-flight fires?

Mr. SCHAITBERGER. For whom?

Mr. LEVITAS. Anybody. Firefighters; flight attendants.

Mr. SCHAITBERGER. Well, firefighters typically would not be receiving that type of training, since we would not be normally present on an in-flight fire. Only in my association and work with the flight attendants am I aware that inadequate training or the lack of training altogether is provided for those situations.

Mr. LEVITAS. Based on what we have heard to date, I think it would be a mistake to use the word "training" to describe what flight attendants get in the course of their orientation with respect to firefighting. To be told and read a book about how you put out a fire is perhaps worse than useless, because you get a lot of misconceptions about what you are doing, and you think you know when you don't have any idea at all.

Mr. SCHAITBERGER. I was just going to say, it is hard to imagine because just again knowing the typical training for firefighters, where they have everything from smokehouses to structures that they place fires in, why a carrier would not provide a simulated cabin—and that, to me, seems to be a very simple thing to do—and to provide atmospheric conditions of smoke or heat or debris, and allow those people the opportunity to receive that type of true on-hands training.

Mr. LEVITAS. Well, we are hearing a lot of very incredible things that don't make any sense, frankly, as to why some things are not being done, both by FAA, where it seems pretty obvious that they can be done and should be done, and by the carriers themselves. So that is just one more.

Let me ask you this last question: There are two federally owned civil airports in the United States which serve commercial airlines. Are you acquainted with the type of firefighting operations located at those two airports?

Mr. SCHAITBERGER. At National and Dulles?

Mr. LEVITAS Yes.

Mr. SCHAITBERGER. Yes. They have a very adequate and capable firefighting force at those two locations. I think that is fair to say. The equipment, particularly at Dulles, which I have personally had an opportunity to review and look at their equipment, they seem to be very adequately provided for.

Mr. LEVITAS. Thank you very much.

Mr. Molinari.

Mr. MOLINARI. You were here yesterday when the film was being shown, weren't you?

Mr. SCHAITBERGER. No, sir. But we have seen similar filmclips.

Mr. MOLINARI. OK. I couldn't help but get the impression in looking at that film that there was something amiss with the manner in which they were directing the spray at the top of the plane. My observation of it was that it was senseless to do it; that there was no way it was going to have any effect upon the fire itself or the destruction of the plane.

Could you give me your thoughts on that subject?

Mr. SCHAITBERGER. Well, I don't know if I can recall that shot. But I suspect that I understand the situation you may be discussing. You must remember that there are several things that you can do with water spray or foam. And a lot of times it isn't directing it directly on the fire. For example, when the top of the plane began to open up or as the top of the plane opened up, a lot of people may think that is when you should just shoot a tremendous stream of water or foam down into—whether it is a building structure or an aircraft structure.

But that is not the case, because then you are pushing into the structure all of the heat and gas and flames. You want that to be able to ventilate. So what we typically try to do is, you approach that situation from within and force all of that out. I suspect that what you saw was them setting up a curtain. That would be a curtain of foam which helps to set up a protective barrier to allow the rescue personnel to make an approach to the aircraft and also to allow individuals to escape and leave the aircraft.

Mr. MOLINARI. Yes.

Mr. SCHAITBERGER. It is normally referred to as a curtain.

Mr. MOLINARI. I understand.

Mr. SCHAITBERGER. It just looks like they are shooting it out into the air, but that curtain cuts off the extreme amounts of radiant heat that are given off.

Mr. MOLINARI. Based on your experience, and it seems that you do have a considerable amount of experience, how would you have handled that fire if you were in charge of the scene and you had adequate personnel with you?

Mr. SCHAITBERGER. Well, I don't think I could answer that, having been a firefighter for so many years, not a fire chief. And also it would be very difficult to answer that question without having been there. From the information we have received, I believe that they made the correct decisions and approaches. I think their equipment and their limited resources were their biggest problem, although I personally, a feeling, do not believe that anything would have made any difference for the 23 unfortunate individuals left aboard the aircraft.

It appears that they made an approach from two sides of the aircraft, which is typically the case. That they were trying to set up a protection on the wing areas where you would have fuel, because you also have to remember not only are they concerned about the fire that is actually going, they have to be concerned about what could be an enormous amount of hydraulic fluids and possible fuels that are left aboard that aircraft that could still be involved in a fire.

So there are several things going on at one time and it appears that they made the two approaches, and I do understand that one set, one crew made an attempt to enter into one of the exits and just were simply forced back.

Mr. MOLINARI. Let us go back to the equipment that we saw here before. Let us assume that we had, whether it was that equipment or another, but let us say adequate equipment. And you were there at a time when entry was still possible. The early part of the landing. In the film we saw, the plane was already on the ground for 9 minutes. So that it seems there was sufficient time. What would a team of firefighters have done upon entry of the plane?

Mr. SCHAITBERGER. If it was prior to flashover, we would have made entry, hands and knees, search and rescue operation; with the small aisles, probably just trying to work from forward to the rear, as opposed to a larger structure where we typically start to the right and work all the way around, or start to the left in search of victims. In that kind of confined space, they would have had with them some kind of a protective line and, on hands and knees, begun their search and rescue from front to rear.

Mr. MOLINARI. Would the emphasis be on search and rescue or preventing——

Mr. SCHAITBERGER. Search and rescue is always our first concern under any circumstances, whether it be a structural, aircraft, brush fire. Search and rescue is always the very first operation. Then you go into a firefighting operation, and after that an overhaul.

Mr. MOLINARI. Could you not maybe achieve the same purpose by trying to prevent the flashover? Is that possible?

Mr. SCHAITBERGER. Well, you can't really prevent a flashover unless you can really get to the seat of the fire in time to put it out. What is really happening in a——

Mr. MOLINARI. It is a judgment call, in other words?

Mr. SCHAITBERGER. Yes; because you are talking about a confined area where all these materials are under extreme amount of heat. Yet they are not an open flame yet. At a certain point they reach a flash point where they just—it would be like throwing a can of gasoline into an open fire. Those materials just literally explode into flame. At that point there is just very little you can do. You have to back off then.

Mr. MOLINARI. Talking about the emergency equipment at the A, AA, and B airports, can you tell us how much emergency equipment they presently have at such airports?

Mr. SCHAITBERGER. Very minimal to say the least. For example, at A airports they are required one lightweight vehicle, providing at least either 500 pounds of dry chemical extinguishing agents or 450 pounds of dry chemical and 50 gallons of water for film foaming production. That is not a lot. That would be for an airport where the aircraft do not exceed more than 90 feet in length.

At a B airport, which would be aircraft 90 to 126 feet and could be jet aircraft, it would require one lightweight vehicle with, at least, extinguishing agent mentioned in (a) below, but the total quantity of water for protein foam production would be 1,500 gallons.

Mr. MOLINARI. What do you suppose the reason is for FAA's attitude on removing that equipment?

Mr. SCHAITBERGER. Well, let me first say that FAA has not really indicated its attitude yet. It is reviewing a study at a cost of, I believe, about a million dollars that was conducted in its behalf. It is our opinion that it is certainly an economically based study. Does the cost of fire rescue equipment and personnel exceed the need or the risk or chance of one of these tragedies happening at that airport?

Mr. Molinari. Money versus lives, is that what it boils down to?

Mr. Schaitberger. I think that would be a fair way of putting it, yes.

Mr. Molinari. On page 6 of your testimony, you have indicated at the center of the page that 80 percent of all accidents occur on the runway, or within 3,000 feet of the threshold. Where did you get those statistics from?

Mr. Schaitberger. I got those from the Airport Safety Services International in a report that was produced for the National Fire Protection Association as an evaluation of the HH Aerospace Design Co. study.

Mr. Molinari. The reason I ask that is because the information we have received indicates that 80 percent of all aircraft accidents occur on landing and takeoff. But many of those would occur beyond that 3,000 feet. So I am having difficulty in my own mind equating that statistic with that which you are quoting today.

I am wondering—one is wrong.

Mr. Schaitberger. Well, although the landing and takeoff, 3,000 feet, and this is just my judgment, that is a considerable distance of, what, almost three-quarters of a mile, two-thirds of a mile. And if you really reflect on a lot of the takeoff and landing accidents, I am not so sure that it would not support the Airport Safety Service's figure.

Mr. Molinari. OK. Let us move off that to the last question. You have made some reference in here to halon 1211 and the toxic impact of being exposed to it. In your report, you do refer to halon 1301. But there is no reference to the toxic qualities. Do you feel the same way about 1301, Mr. Duffy?

Mr. Duffy. Again there is a number of different halogenated alkaline extinguishing agents and compounds. The difference is the nomenclature that identifies various components of it. From the 1200, 1300—there is a 2400 series now—they all have various amounts of toxicity. Whether an actual agent itself or decomposition of byproducts when exposed to a hot area, again, the amount of toxicity has been looked at thoroughly by a National Fire Protection Association committee that looks at halon fire extinguishers. We don't have that all with us here, of course, but that should be available through NFPA.

I am not sidestepping your question but NFPA would probably be the expert to answer that question.

Mr. Molinari. You don't feel you are expert enough to pass upon that question?

Mr. Duffy. Oh, certainly not.

Mr. Molinari. Thank you. I have no further questions, Mr. Chairman.

Mr. Levitas. Thank you, Mr. Molinari.

Dr. Rowland.

Mr. Rowland. I have just two questions. On page 2 of your testimony you mentioned some seat-blocking material and said that the FAA announced its intention to promulgate standards which would require the use of seat-blocking material in cabin interiors. What is seat-blocking material?

Mr. SCHAITBERGER. It is where they would still continue to allow the polyurethane foam as the base for the seat, but the seat would then be covered by a material, illuminized, kevlar, a fire-resistant material, which would prevent, hopefully prevent the fire from, on top of a seat, let's say, from burning down into the cushion, or if somehow a fire began underneath in the cushion, it would, hopefully, help to trap some of the products into that seat.

Mr. ROWLAND. That is an acceptable thing, then, to have the seat-blocking material?

Mr. SCHAITBERGER. Oh, absolutely. It is an excellent step forward.

Mr. ROWLAND. We talked about the cost of the equipment versus the lives. Can you give me an idea about the cost of the suit we saw earlier and the oxygen apparatus?

Mr. DUFFY. That particular suit as an approach suit runs roughly $700, $800. It is an aluminized kevlar, three-piece system with a full hood, and there is a gold face. The face is gold layered to allow them to get close to radiant heat. Roughly $700 to $1,000 price range.

Of course an option on the equipment would be to put a pouch on the back, as Mr. Schaitberger said, to allow for breathing apparatus to be worn underneath. The breathing apparatus we demonstrated was approximately $1,000, say, an off-the-shelf price. A little less if you buy it on a competitive bid.

This other device we have here is the device that the flight attendants discussed, using a poor word, a smoke mask. It is not a smoke mask. It is a self-contained breathing apparatus which is termed an escape emergency, self-contained breathing apparatus which allows for a full 5 minutes. Well, if you want I could show you.

Mr. SCHAITBERGER. We thought maybe the committee, since you had not seen one that is self-contained——

Mr. DUFFY. There are two types of smoke masks being marketed to people right now. One is, as I said, an emergency self-contained breathing apparatus. It has a compressed air cell—two in this one—cylinders which allow a full 5-minute period, time of air. As Harold says, what you do, you would take this particular product, open it up. That long strap would go around your neck. You would pull that ring. And then place the hood over your head.

Mr. ROWLAND. What is the cost of that?

Mr. DUFFY. That would cost approximately $200 to $300.

Mr. LEVITAS. It is not heavy.

Mr. ROWLAND. Is it very practical to have enough of those onboard an aircraft to have time to take care of all the passengers?

Mr. DUFFY. In an emergency I would imagine it is very practical. I am not being facetious. One real advantage of this, if you remember, the breathing apparatus we showed here today which a firefighter wears——

Mr. MOLINARI. Before you get off that one, is that full 5 minutes of oxygen breathing time?

Mr. DUFFY. Not oxygen. That is compressed air, 21 percent.

Mr. MOLINARI. But it is 5 minutes, so that assuming—you have got 5 minutes of safe air. Then you have got whatever other additional time you could get like some of the people that were in that Air Canada plane.

Mr. DUFFY. That is correct. One advantage as you pointed out, the firefighters mask again, you lose all your peripheral vision from it. There is a lot of claustrophobia problems. In fact, we experience, the fire instructors experience it with new firefighters. That particular mask you see, you do not lose your peripheral vision, thus you are not in that real high anxiety atmosphere.

The individual can see well around him. And if he is provided air. If I may, there are other smoke masks on the market right now. After the MGM fire a number of companies, a number of imports were sent into the country called emergency smoke masks, a few other words, and they were sold to every traveler, they were sold through travel agents, they were even attempted to be sold through fire departments. They are, if I may, a sham. They don't work. Many are flammable. They do not provide a compressed air resource such as this does. One filters some carbon monoxide, but a real problem in a fire, especially in a fire in a confined area such as an airplane is that you very often get oxygen deficient atmospheres.

Back in the late 1960's the fire departments in this country realized the problem of using a cannister-type mask or filter mask, and after a number of lawsuits initiated in Boston and New York and Sacramento, CA, ceased to use the filter-type breathing apparatus. All fire departments, now, where breathing apparatus is worn, will use compressed air configurations.

I just lend a word of information to the committee. If you do see products such as a filtering type smoke mask, they do not work and they probably should not be sold.

Mr. MOLINARI. How about the heat resistant quality of that hood, any specifications on that?

Mr. DUFFY. Something happened when you use compressed air. There is continual air flow. When you take a compressed air cylinder with compressed air in it and allow air to flow out you get a cooling mechanism so you have to take that variable into account when you measure the flammability of the face piece. There are some very flammable—not flammable but products that will melt. For example, the strapping material on the firefighter's breathing apparatus in this particular case is made out of polypropylene. It melts at about 200 degrees. However, you make it out of products such as kevlar and it will last and won't break off.

That particular device was specifically designed for industry whereas a worker had heard a, for example, carbon monoxide alarm go off, he would don that and get out of his work area. Again it wasn't designed for the aircraft industry. I am sure it could be adapted. There are a lot of high temperature thermoplastics available.

Mr. ROWLAND. Thank you, Mr. Chairman. I have no further questions of these gentlemen. And I thank you. I would just be interested to know how practical it would be to have this type of life-support system onboard aircraft for all passengers.

Thank you.

Mr. LEVITAS. Thank you, Dr. Rowland. Thank you, gentlemen. I have no further questions. We appreciate your contribution today.

Tomorrow the subcommittee will convene at 1:30 in the afternoon in this room. And the witnesses tomorrow will be the Airline Pilots Association, additional flight attendant groups, the Aviation Consumer Action Project, and then we will have testimony and demonstration of various protective breathing device technology of the sort we have heard described previously.

I think today's testimony has been unusually helpful. I must say that I am extremely unhappy with what I have been hearing as far as the response of FAA in this area. I wish I could say that I was surprised as well as unhappy, but unfortunately, I am not at all surprised. But what we have heard today I think should give no one any comfort about the fact that we are doing as much as we can, or that FAA is doing as much as it could, or that the carriers are doing as much as they could to protect the public.

And I thought Congressman Molinari's statement, or observation when he was analyzing the response of the last witness and said you mean it is a question of money versus lives, is a question that may have to be asked again and again. Is it more costly to put in some of these items of equipment, material, or is it less costly every 10 years to pay off the claims as a result of an accident? If that is all we are looking at, cost benefit.

But certainly I think we have obtained some additional and very invaluable insights into this problem of cabin safety. And I believe the witnesses tomorrow, and in the days ahead, will further add to this. But I am convinced now more than ever that unless we get some satisfactory response from FAA, in very short order, that it is going to be necessary for there to be legislative action taken. This has gone on much too long.

If there is no further business to come before the subcommittee this afternoon, then the subcommittee will stand in recess until 1:30 p.m. tomorrow afternoon.

[Whereupon, at 4:18 p.m., the subcommittee was recessed, to reconvene at 1:30 p.m., Thursday, July 14, 1983.].

AVIATION SAFETY

(Aircraft Passenger Survivability and Cabin Safety)

THURSDAY, JULY 14, 1983

House of Representatives,
Subcommittee on Investigations and Oversight,
Committee on Public Works and Transportation,
Washington, DC.

The subcommittee met, pursuant to call, at 1:30 p.m., in room 2167, Rayburn House Office Building, Hon. Elliott H. Levitas (chairman of the subcommittee) presiding.

Mr. Levitas. The Subcommittee on Investigations and Oversight will please come to order.

Over the past 2 days we have heard extensive testimony about the difficulties, both flight crews and passengers faced when confronted with the dense smoke and fumes from an in-flight fire. When we began these hearings on Tuesday morning I remarked that I was disappointed in the dismal record of the FAA in regulating air safety. Two days later I would have to comment that to use the word "disappointment" would be a gross understatement.

We have had contradictory testimony on the actual number of fires which are reported as having occurred on board aircraft, presumably due to the various categories in which fires can be reported. But there still remains a lingering concern with some of us that some fires are never reported at all.

A surviving passenger from the Air Canada accident last month gave an excellent accounting of the conditions aboard the ill-fated aircraft as it descended from 31,000 feet to a landing at Cincinnati Airport. While all the facts are not yet in, it would appear that not enough information and assistance was provided to passengers confronted with the spreading smoke and fumes.

From the testimony given by the Association of Flight Attendants yesterday afternoon, it would further appear that safety is still being ignored in the classrooms where flight attendants receive their instruction and that questionable hands-on training does not afford them the information they need to respond to inflight fires.

We will devote some specific time to this item when witnesses for the FAA and air carriers are called upon to testify. Our last witness yesterday reinforced the testimony developed during the appearance of the National Transportation Safety Board as to the firefighting capability of the airports around the Nation.

Obviously there is some attention which must be directed to this situation, also. Now, this afternoon we will begin with a representative of a company which has done extensive work in the matter of cabin environment, specifically dealing with pressurization, ventilation and the control of another adversary, ozone. The thrust of the testimony will be directed at the emergency life support systems for passengers and flight crews.

Subsequently we will hear from the airline pilots, two additional flight attendants and the Aviation Consumer Action Project, an organization which has been involved in safety matters for many years. Now, before hearing from the first witness today, I would like to inquire whether the gentleman from New York, Mr. Molinari, has an opening statement?

Mr. MOLINARI. Yes, I do, Mr. Chairman. Thank you.

I should like to voice my concurrence with the remarks of the chairman. As I pointed out in my opening statement 2 days ago, our committee records are replete with promises by the FAA to move aggressively to improve and update the standards applied to cabin materials flammability, seat strength and other matters. Each promise was followed by more study, more procrastination and, finally, no action at all.

I looked askance at the move to cancel all pending proposed regulations while a committee appointed by the FAA, known as the Special Aviation Fire and Explosion Reduction Committee, commonly known as the SAFER Committee, was set up to study the problems. This committee gave the FAA another 2 years in which it did not have to act.

Now, we are hearing about how the FAA is going to conduct a test crash of an old transport aircraft next year in order to study the results and arrive at some conclusions, tentative or otherwise. I have misgivings that this episode might be just another buyer of time for the FAA and may move any real progress in cabin safety down the road a few more years. I do not think that this committee of the Congress, or Congress itself, is going to give the FAA this further excuse. If something isn't done very promptly, there will be more than ample legislative incentive to initiate and achieve the desired results.

Improvements in the field of aviation cabin safety have been held in suspended animation for far too long, and at the cost of hundreds of human lives. And I do also want to add, Mr. Chairman, that I have found the National Transportation Safety Board to be a responsible body, and one that has served as a consumer advocate in this area.

But I was shocked and surprised this week to find out that they were totally ignorant when they testified on the question of a polyamide material which has been developed and is used by NASA and which would have provided a margin of 5 minutes for survivability in that Air Canada crash as opposed to 2 minutes with the existing materials.

I did a little reading on it in the last day or two. So, I just want to say that I feel that NTSB does share some responsibility and blame here. I think that they could have done more, and to find out they weren't even aware of this material when it has been tested extensively and I believe holds some real promise for the saving of lives such as were lost in the Air Canada crash is inexcusable.

Thank you, Mr. Chairman.

Mr. LEVITAS. Thank you very much, Mr. Molinari.

The first witness today is Mr. Bertil Werjefelt. He is President of the Xenex Corp.

Mr. Werjefelt, we welcome you here today. Your entire statement will be made fully a part of the record. And I would request that you would summarize your testimony for us so we might get into our questions for you. We thank you for being here.

Would you raise your right hand, please?

[Witness sworn.]

Mr. LEVITAS. Thank you very much, Mr. Werjefelt.

Mr. MOLINARI. Would the chairman yield a second? I didn't have a copy of the statement. I wonder if we have copies here we can provide to the other members of the subcommittee as they come in.

Thank you.

Mr. LEVITAS. Thank you. We welcome you and look forward to your testimony.

TESTIMONY OF BERTIL WERJEFELT, PRESIDENT, XENEX CORP.

Mr. WERJEFELT. Thank you. I want to thank you for the opportunity to present our views on the serious issues of passenger safety in airline cabins. I am aware of your work over the years, and the extensive testimony that is available that I have read through. I really commend you for that persevering effort. Before I begin my testimony I want to make it clear to all that I am not here to sell a product. I have been asked, and my purpose, is to explain some serious and complex problems in aviation and the state-of-the-art, technical solutions to them.

Xenex Corp. is involved in basic proprietary research and development work. In May of last year I testified before the Senate Aviation Subcommittee concerning Senate bill 1770. This bill has as its purpose to promote and maintain a superior U.S. aviation industry and, therefore, the bill inquires into quantity of fresh air per occupant and overall quality on board. The quantity and quality of humidification, air contamination limits, emergency breathing equipment, including toxic fume protective breathing equipment, measures, procedures and capabilities for existinguishing fires and removal of smoke and toxic fumes within safe pressurization limits, plus safe pressurization relating to the cardiopulmonary health of the traveling public and collection of a data base of medical data.

Although at first blush it would appear that the enumerated items in my prepared statement, items three, four and five, which are air contamination limits, emergency breathing equipment and smoke removal and fire extinguishing means, are only relevant to this hearing. This is not true. The simple reason being that the confined structure of an airliner cabin is, a total life support system. Few people are aware of this. Therefore, there is considerable interrelationship of these subject matters. In other words, it is difficult to address one without addressing the other.

I will try to be brief. My statement is lengthy.

Items 1, 2, 6(a), and 6(b)

Concerning ventilation, for health and safety reasons, pilots are provided from 75 to 250 cubic feet of fresh air per person per minute. At the same time the fresh air ventilation rate in the passenger cabin of an aircraft may be below 7 cubic feet per person per minute by design.

There are no regulations under the operating requirements of the Federal Aviation Administration regulations stating the minimum requirements of fresh air for occupants of the passenger cabin. It should be carefully noted that studies and evidence suggest that fresh air ventilation rates on the order of 5 cubic feet per person per minute may cause a disease transmission rate of up to 72 percent. This means that on a jumbo jet with 400 people, 300 of the passengers could be infected by influenza or other highly transmissible diseases from one single individual. I have personally measured fresh air ventilation rates below 4 cubic feet per person per minute.

As it concerns humidification of the air on board an aircraft, it is now well known that in some cases up to 90 percent of the moisture in the air is nothing other than the unsterilized breath and sweat from other occupants which, in fact, is being recirculated in the passenger cabin. You experience a rise in carbon dioxide levels due to these low fresh air ventilation rates. This is known to cause cardiac arrhythmias, especially to people with marginal cardiac status. There are millions of such people.

The issue of safe pressurization, coupled with carbon dioxide levels is a serious one. If pressure is too low and the carbon dioxide level is too high, the effects can be lethal. A study shows that approximately 30 percent of the patients in the cardiac care unit of a major Honolulu hospital were from out of State; at any one time the out-of-State visitors never account for more than approximately 4 percent of the population, so why the disparity in these figures?

Moreover, Dr. Canete's study showed that on a percentile basis, 6 to 7 out of every 100 air travelers with ischemic heart disease, as defined in his study, die 3 to 4 days after air travel. His study is not definitive in the sense that it did not account for local residents traveling by air nor did it account for what influence elevated levels of carbon dioxide in the aircraft cabin would have had on the study or if, in fact, this may have been the cause of the frightening results. In fact, the percentage of fatalities could be twice as high. Statistically speaking, these numbers are on the same order of magnitude as the study that alerted the world to the presence of toxic shock syndrome—nearly exactly.

You may wonder why I bring up these issues. I have taken the liberty to do so for two reasons. First, to show that there is much more to flight safety than the sensational aspects of charred bodies and burning wreckages. Second, the health safety data I just discussed has great significance in establishing safety criteria for emergency situations.

For example, the poor fresh air ventilation rates in the passenger cabin presents an already marginal condition for the occupants in the event of a fire, smoke or toxic fume emergency. Whereas, in the cockpit there are, for instance, regulations in effect for smoke evacuation as well as protective breathing equipment for the pilots.

I guess we are all familiar with the Saudi tragedy. It has been reiterated here several times. I would like to point out that not only did all the passengers perish but so did the crew. There were 12 bodies, I am informed, that were found in the cockpit. That is the last place there was any breathable air. The pilots were behaving irrationally, as they were in a very casual manner taxiing the plane down the runway. It seems to be a clear indication that they had been overcome by the toxic fumes already at that point. Three hundred and one people perished there, among them 11 Americans.

According to FAA records, 95 percent of which we surprisingly located in the maintenance files of the FAA computer, there are approximately 600 occurrences every year of fire, smoke, fumes and explosions aboard U.S. transport aircraft which have been reported. These are the ones that have been reported. I don't know how many have not been reported.

The records that I am talking about cover a period of just over 5 years. Total occurrences, 3,022. Of these, 157 were separately classified as accident/incident. The balance, 95 percent or 2,865 reports, which I have here for your inspection, covered everything from minor electrical problems to unscheduled landings due to smoke-filled cabins. Hundreds of them, and all of them are not denoted in the report as unscheduled landings. There is only a limited amount of space to denote the data in there.

Some are, however, marked. In one case I ran across where there was a mailbag on fire, requiring that the floor be axed open in flight, with a subsequent unscheduled landing. This is in the maintenance files, service difficulty reports. Between every 6th and 10th plane in our fleet, of a total of about 3,900 airplanes in this country, are affected.

I have heard the Aviation Safety Institute report that there is a lavatory fire every 2 weeks.

According to testimony previously provided by the Aerospace Industries Association in Senate hearings, 90 percent of all aircraft fires occur in flight where we are virtually helpless. We are really helpless at that point.

Pilots, by regulation, have 15 minutes of protective breathing against toxic fumes. This regulation is outdated and inadequate from a safety standpoint.

Smoke evacuation within safe pressurization limits is also provided for pilots by regulation. This regulation is also, inadequate, which was proven in the recent disaster—and many before that.

As it concerns protective breathing equipment for the passengers during an in-flight emergency, there is a popular misconception that the passenger oxygen masks are useful for this purpose. I would like to set that straight. I will quote out of the emergency procedures of a pilot's manual: "It is not recommended that the passenger oxygen mask be deployed when excessive smoke is in the passenger cabin. The passenger oxygen masks are not smoke masks and were not designed, tested, or certified to serve this purpose. These masks supply a breathing mixture which consists primarily of cabin air admitted through an inlet valve on each mask and a relatively small amount of pure oxygen from the cabin oxygen distribution manifold. Thus, in a smoke-filled cabin any noxious fumes would be inspired directly into the passenger oxygen mask and the small amount of oxygen present would provide no significant displacement or dilution of toxic agents."

In this most recent episode with the Air Canada disaster it was mentioned several times that the pilot did not deploy the masks because of the increased hazard that the oxygen would contribute to fueling the fire. The amount of oxygen available by regulation is 3 minutes of supplemental oxygen. I stress supplemental. It will do little or nothing to fuel a fire. In the case of the Air Canada disaster it would have added between one-tenth to two-tenths of 1 percent to the oxygen content in the air on board, which normally is 20.9 percent.

To go on further, the firefighting equipment available in the passenger cabin, for instance on a wide-bodied aircraft, with a passenger capacity of 450, is approximately the equivalent of a couple of buckets of water and, in some cases, two small chemical extinguishers. I have more than that in my house for five people. Here we are talking about 450 people.

As it concerns the cabin in the plane, what I have just cited is literally no different than being in a fully occupied theater and after discovering a fire, finding out that all the doors are locked and there are only a couple of buckets of water to extinguish the fire, the person who has the keys to the locks will be back in 20 or 30 minutes, if you are lucky. You are stuck up there!

The reason there is so little firefighting equipment available in the passenger cabin is largely because of the toxic and/or oxygen depriving nature of the fire extinguishing components. We heard that yesterday. The previous efforts within the FAA to come up with a solution to this, I am not going to dwell upon. It has been either too costly, too complex, too hazardous, or not meaningful enough. Xenex Corp. has developed systems that overcome all the previous objections and, in fact, provide an unlimited duration of breathable air for passengers as well as crew. We will be seeing a video a little later about this.

The system can be implemented immediately for 80 percent of the Nation's passenger seats without modification to the aircraft. Implementation can be accomplished without taking the aircraft out of service. The other 20 percent requires some minor modification which can be readily accomplished in the course of regular servicing of the aircraft.

Companies we are licensing our technology to are in a position to produce the portable emergency life support systems, PELS. For several years Xenex Corp. has worked within the system in order to accomplish a uniform industry adoption of toxic fume protective breathing equipment. This we felt would be in the best public interest. Needless to say, the wheels of progress turn slowly. Today, after more than two decades of knowing of the asphyxiation problems there are neither instructions nor safety equipment available to passengers in the event of in-flight fire, smoke and toxic fume emergencies.

We have developed a PELS unit with universal adaptor, which can be fitted on any common air outlet and thus be sold directly to the public. Anyone who wishes can carry their own equipment onboard an aircraft. We have refrained from pursuing this course of action. The reason: we feel it is the responsibility of the FAA to attend to these basic safety matters through the regulatory process. Advertising our products on radio, television, or in the press would most certainly alarm the public to the detriment of the industry. Nevertheless, in the absence of prompt regulatory action, we will pursue this course as soon as possible. Further delays, depriving crew and passengers of their right to lifesaving equipment, are improper and not justifiable.

There have been some recent rulemaking proposals which I touch on in my prepared statement. There was one in 1969 which discussed implementation of a smoke hood. Unfortunately, that hood did not have any air supply which rendered it rather meaningless from the standpoint that when you don it, you may have as much smoke in the hood as you would have outside. Usually you don't don one of those things until you have discovered the smoke.

The most recent rulemaking proposal, which was buried in the rules by objective, was paragraph 120.69, paragraph (a)(8). Rules by objective were withdrawn, as you may recall, about 2 weeks ago; 120.69 specifically addressed toxic fume protective breathing equipment for passengers as well as crew. I hope the FAA will consider putting it back in promptly.

As regards the pilot's regulatory protection of 15 minutes, this as we well know, especially with the Air Canada circumstance, is hardly enough. They were very, very fortunate to be right in the vicinity of an airport. As it concerns the FAA regulation, which we hope will be forthcoming, technology now exists to provide an unlimited duration of protection.

However, from a minimum requirement standpoint, I believe that there is considerable agreement in the technical and scientific community that one-half to one hour overland would be reasonable protection to have, depending on the type of operation of the aircraft. Overseas you should have enough to cover you from any point on the overseas sector, to a suitable airport.

There have been arguments about smoke hoods in the past—you can't see through them. Nobody can really see in a smoke-filled environment anyway. As long as they are reasonably transparent, I think that would be sufficient.

The issue was raised that people would suffocate from the use of smoke hoods. You can't have a total panacea. You can't get everything under one roof. The simple facts are that we need toxic fume protection onboard aircraft. There may be someone, who for whatever reason, uses the equipment improperly. This should not serve to deprive all those who can and will use the equipment properly of their right for reasonable and meaningful life safety equipment for their survival in the face of known life-threatening hazards.

As to reducing flammability of cabin interiors, I think that is a very good effort. However, we should also be aware of the fact that it is not possible to create a fire or smokeproof aircraft, even if you made the seats and interiors of stainless steel. Why? Because luggage, cargo, clothing, and fuel also pose lethal hazards in themselves.

I will take the liberty to quote a few of the horror stories from a recent issue of SAFE Journal:

> For example, hydrochloric acid that had been packed in a tile company employee's checked luggage leaked. It was discovered when the resultant smoke was seen

coming from the baggage compartment. In another, an employee of a rocket manufacturing company packed live rockets in his suitcase and checked it through to his destination—a government firing range. A flammable cleaning solution leaked from a bag checked by a ski lift contractor. A package checked as baggage, containing 20 pounds of liquid fiberglass hardener, was on fire when baggage handlers unloaded the aircraft cargo compartment. Flammable corrosive samples in a salesman's carry-on luggage leaked and filled the aircraft cabin with an offensive odor. A passenger accidentally spilled a water reactive chemical from his brief case on his newspaper. He asked the flight attendant to place the newspaper in a bucket, as it would ignite if it became wet. Gasoline samples, being taken to a testing laboratory, leaked from an oil company employee's luggage. A salesman checked baggage containing 2,000 rounds of 38-caliber ammunition.

Obviously we need toxic fume protection and improved fire extinguishing means. To merely address the matter of improved fabrics is like saying that we will improve the fire resistant materials in buildings but we will not provide sprinklers, fire hoses, smoke alarms or a fire department. Nor will we provide any meaningful way of venting the smoke or evacuating the building. This is unthinkable in our daily nonaviation environment.

The cost for implementing toxic fume protection and appropriate fire extinguishing means will be a few cents per passenger. This, I submit, is cost effective in the mind of any person, especially those who are aware of the life-threatening hazards that currently exist. I need not remind you that cost effectiveness or cost benefit analysis has been discussed endlessly in the past. The only cost-benefit analysis that means anything is what the public is willing to pay for its own safety. I submit that there is not one air traveler around who would not accept a small added cost of a few cents on their ticket, which in many cases costs hundreds of dollars, this for the purpose of dramatically improving their chances for survival in the event of a disaster. Certainly the 23 unfortunate souls in the Air Canada disaster could have been saved had they not been overcome by toxic fumes. That is the best I understand the situation to be now since no accident report has yet been issued. Moreover, it is my considered opinion that the public mistakenly believes that the protection is already in place and that they are already paying for it.

The last issue that I have, which I think we should seriously consider in the future, is how to assess safety. Current practice in the aviation industry is to measure distances, how many passenger miles do you fly, or how many takeoffs and landings do you have between fatalities. I submit that is like counting the number of footsteps hotel guests complete collectively per asphyxiation fatalities or the number of times the doors open on buses in relationship to bus fatalities. We think this is wrong. In fact, it invokes a false sense of security not only to the detriment of the industry in the long run, but also to the public.

The best way to find a common denominator in assessing safety is to measure the amount of time you spend in a facility. One hour in a plane, a train, a boat. That would give you a reasonable comparative assessment on the safety features of the various modes. In addition, I think it would be useful to consider the inventory of structures or vehicles that we have, and see how many of them are involved in accidents or otherwise contribute to disasters, what have you. Therefore, from that we can determine that 1 out of 10 hotels or 1 out of 10 airplanes, or whatever is affected, and thereby improve our record.

In conclusion, we are cognizant of the readjustments the airline industry has been forced to make as deregulation has become a reality. Many, but not all, airlines are now in dire financial straits. Obviously, it can be argued that if they cannot afford to provide minimum or reasonable safety protection, then they really should not be in business. They are a detriment to industry itself, and obviously to public safety.

I have mentioned that a small limited tax of some sort or fee on a ticket, industrywide, for a period of time, could perhaps assist the industry to get the funding to go ahead and pay for whatever improvements the committee—or FAA—finds that are necessary immediately. Obviously, improvements will be slow in coming, if there isn't money there. If the airlines are strapped for cash, why, they won't come at all.

One last thing: I hope we are all striving for the same thing. That is: to maintain a superior aviation industry in this country. Is that the underlying effort of all of us?

I hope I covered all my material here.

I thank you for the opportunity to present the testimony.

[The prepared statement of Mr. Werjefelt follows:]

PREPARED STATEMENT OF BERTIL WERJEFELT, PRESIDENT OF THE XENEX CORP.

My name is Bertil Werjefelt. I am president of Xenex Corporation. I want to thank the Chairman for the invitation to present testimony on the very important issue of passenger safety in airliner cabins.

I am aware of Congressman Levitas' long standing interest in aviation safety and his laborious work over the years to cause improvements in this area. I have read with considerable interest, the records of numerous hearings that detail serious safety deficiencies, brought to light by the persevering efforts of the Chairman.

Xenex Corporation is an organization involved in basic proprietary research and development work in energy conversion systems. Our research ranges from the esoteric areas of nuclear, electromagnetic and photocatalytic systems, to the more ordinary energy conversion systems as can be found on aircraft for pressurization, ventilation and controlling contaminants such as ozone. In addition, over the last several years our company has been involved in the research and development of a portable emergency life support system particularly suited for use by passengers and crew on board airliners.

On May 20, 1982, I testified before the United States Senate Subcommittee on Aviation concerning Senate Bill 1770, a bill introduced by Senator Daniel K. Inouye (D. Hawaii) and co-sponsored by Senator Barry Goldwater, Senator Melcher and Senator Specter. The Bill, which is now known as SB 197 directed the Secretary of the Department of Transportation to conduct an independent study to determine the adequacy of certain industry practices and Federal Aviation Administration rules and regulations. In the interest of promoting and maintaining a superior U.S. aviation industry the purpose of the bill is to determine: (1) quantity of fresh air per occupant and overall quality of air on board; (2) quantity and quality of humidification; (3) air contamination limits; (4) emergency breathing equipment, including toxic fume-protective breathing equipment; (5) measures, procedures, and capabilities for extinguishing fires and the removal of smoke and toxic fumes within safe pressurization limits; (6)(a) safe pressurization, considering the broad range of cardiopulmonary health of the traveling public; dissemination of information to the medical profession and the general public of current pressurization limits and practices to assure valid medical advice concerning the health effects of air travel; and (b) collection and dissemination by the aviation industry, the Federal Aviation Administration, and/or any other private or governmental organization of a data base of medical statistics relating to air travel, in an effort to assess the adequacy of aircraft systems, design, regulation, standards and practices from a health and safety standpoint and for the purpose of issuing Federal Aviation Administration administrative advisory circulars and airworthiness directive to correct any deficiencies disclosed.

Although at first blush it would appear that only Items 3, 4 and 5, Air Contamination limits, emergency breathing equipment and smoke removal and fire extinguishing means, are relevant to this hearing. This is not true. The simple reason being that the confined structure of an airliner cabin is, a total life support system, therefore, there is considerable interrelationship of these subject matters. In other words, it is difficult to address one without addressing the other.

I will, therefore, briefly explain the problems as they relate to the enumerated items and thereby accentuate their direct and indirect relationship to safety during normal as well as emergency conditions.

No. (1) quantity of fresh air per occupant and overall quality of air on board; (2) quantity and quality of humidification; (6)(a) safe pressurization, considering the broad range of cardiopulmonary health of the traveling public....; and (6) (b) collection and dissemination by the aviation industry, the Federal Aviation Administration, and/or any other private or governmental organization of a data base of medical statistics relating to air travel.

The FAA agrees, as does the Air Transport Association (ATA), as well as the Aerospace Industries Association, that there is a difference in the amount of fresh air supplied to various occupants on board an aircraft. For health and safety reasons pilots are provided from 75 to 250 cubic feet of fresh air per person per minute. At the same time the fresh air ventilation rate in the passenger cabin of an aircraft may be below 7 cubic feet per person per minute.** There are no regulations under the operating requirements of the Federal Aviation Administration regulations stating the minimum requirements of fresh air for occupants of the passenger cabin.

In expert circles it is well recognized that 40 to 60 cubic feet of fresh air per person per minute is an appropriate minimum to provide for a minimum safe health standard in the confined and crowded environment of an airline cabin. A lesser fresh air ventilation rate considerbly increases the risk of transmission of contageous diseases. The very low fresh air ventilation rates in the passenger cabin has resulted in a substantial increase in virus, bacteria, fungus and other micro-organisms in the cabin air. This matter has been documented in the Senate Aviation Subcommittee files. In fact, the data shows that the bacteria colony count in this room could be expected to be maximum 1 to 2 colonies while at the same time it has been found to be in excess of 250 colonies in some tests made on board aircraft.

A further consideration which should be carefully noted is that studies and evidence suggest that fresh air ventilation rates on transmission rate of up to 72%. In other words, on a jumbo jet carrying more than 400 people, more than 300 of the passengers could be infected by influenza or other highly transmissible diseases from one single individual!

I have personally measured fresh air ventilation rates.

As it concerns humidification of the air on board an aircraft, it is now well known that in some cases up to 90% of the moisture in the air is nothing other than the unsterilized breath and sweat from other occupants which, in fact, is being recirculated in the passenger cabin.

Moreover, dangerously low fresh air ventilation rates give rise to elevated levels of carbon dioxide in the passenger cabin. This is known to cause cardiac arrhythmias to individuals with a marginal cardiac status. there are millions of people in this country whose cardio-respiratory conditions are marginal.

As it concerns "safe pressurization . . ." presently there are no operating regulations which dictate an appropriate maximum cabin altitude. In other words, minimum prssure in the cabin. What influence pressure and carbon dioxie have, particularly on individuals with marginal cardio-respiratory conditions, is to some extent well known. If the pressure is too low and the carbon dioxide level too high the effects can be lethal. In fact, we submitted a study conducted by Dr. Danelo Canete, former Senior FAA Medical Examiner in Honolulu, which shows that approximately 30% of the patients in the cardiac care unit of a major Honolulu hospital were from out of state; at any one time the out of state visitors never account for more than approximately 4% of the population. Moreover, Dr. Canete's study showed that on a percentile basis, 6 to 7 out of every hundred air travelers with ischemic heart disease, as defined in his study, die 3 to 4 days after air travel. His study is not definitive in the sense that it did not account for local residents traveling by air nor did it account for what influence elevated levels of carbon dioxide in the air craft cabin would have had on the study or, if in fact this may have been the cause of the frightening results. In fact, the percentage of fatalities could be twice as high. Statistically speaking, these numbers are on the same order of magnitude as the study that altered the world to the presence of toxic shock syndrome.

I have taken the liberty to briefly bring these matters to your attention for two reasons. First, to show that there is much more to flight safety than the sensational aspects of charred bodies and burning wreckages. Secondly, the health safety data I just discussed has great significance in establishing safety criteria for emergency situations. For example, the poor fresh air ventilation rates in the passenger cabin presents an already marginal condition for the occupants in the event of a fire, smoke or toxic fume emergency. Whereas, in the cockpit there are, for instance, regulations in effect for smoke evacuation as well as protective breathing equipment for the pilots.

Although the recent unfortunate Air Canada disaster in Cinncinati clearly indicates the need for toxic fume protection and fire extinguishing means, it is not the first time such disasters have occurred. You may recall that in 1980 a Saudi Tri-Star had a fire on board and landed 10 minutes after discovery of same only to find that all passengers on board were asphyxiated. Not only all the passengers perished but ultimately so did the crew. Twelve bodies were found in the cockpit, the last place where there was any breathable air. The irrational behavior of the pilots as they lackadaisically taxied the plane down the runway was clear indication that these highly skilled professionals had been overcome by the toxic fumes and knew not what they were doing. 301 persons died in this disaster, among them 11 Americans.

The records over the past two decades concerning the arguments of safety criteria in aviation is very acrimonious and surely numbers several tens of thousands of pages of documentation. The time has now come to stop arguing and start acting. This is especially true since there now is rather unanimous agreement at last on some direly needed improvements. We are past the point of who of us in industry or government should be blamed; who in the past has been derelict or remiss in their responsibilities. It is now time to take the bull by the horns and define the problems and the solutions in their proper perspective and from there formulate a plan for implementation. I stress that the ultimate purpose of this is to promote and maintain a superior U.S. aviation industry which can be looked on with envy and hopefully be adopted by the rest of the world.

Therefore, as it concerns Items 3, 4, and 5 namely, air contamination limits, toxic fume protective breathing equipment and fire extinguishing means, the state of affairs and problems are as follows:

According to FAA records, 95% of which we surprisingly located in the maintenance files of the FAA computer, there are approximately 600 occurrences every year of fire smoke fumes and explosions abroad U.S. transport aircraft which have been reported (how many have not been reported?).

The records cover a period of just over 5 years. Total occurrences: 3022! Of these, 157 were separately classified as accident/incident. The balance, 95% or 2865 reports, covered everything from minor electrical problems to unscheduled landings due to smoke filled cabins. In one case I believe there was a mailbag on fire, requiring that the floor be axed open in flight, with a subsequent unscheduling landing. Maintenance problems? Service difficulty?

This means that essentially every tenth plane in our entire fleet has such an occurrence every year. According to recent reports by the Aviation Safety Institute there is a lavatory fire every two weeks. In testimony submitted by the Aerospace Industries Association 90% of all aircraft fires occur in flight where we are virtually helpless. Pilots, by regulation, have fifteen minutes of protective breathing against toxic fumes. This regulation is outdated and inadequate from a safety standpoint. Smoke evacuation within safe pressurization limits is also provided for pilots by regulation. Again, most recently in the Air Canada disaster this proved to be inadequate.

Although the public believes otherwise, passengers' oxygen masks are useless for toxic fume protection purposes. I will quote from the emergency procedures of a pilot's manual for a popular transport aircraft manufactured in this country. "It is not recommended that the passenger oxygen masks be deployed when excessive smoke is in the passenger cabin. The passenger oxygen masks are not smoke masks and were not designed, tested or certified to serve this purpose. These masks supply a breathing mixture which consists primarily of cabin air, admitted through an inlet valve in each mask, and a relatively small amount of pure oxygen from the cabin oxygen distribution manifold. Thus, in a smoke-filled cabin, any noxious fumes would be inspired directly in the passenger oxygen masks, and the small amount of manifold oxygen present would provide no significant displacement or dilution of toxic agents."

Contrary to popular belief the oxygen, which by regulation only amounts to three minutes of supplemental oxygen will do little or nothing to fuel a fire. In the case of the Air Canada disaster it would, at most, have added between one-tenth to two-tenths of 1% to the oxygen content in the air on board.

The fire fighting equipment available in the passenger cabin, for instance on a wide-bodied aircraft, with a passenger capacity of 450, is approximately the equivalent of a couple of buckets of water and, in some cases, two small chemical extinguishers!

The immediate preceding statements need to be put in perspective. In the event of a fire, smoke and toxic fume emergency when cruising at, for instance, 35,000 or 40,000 feet the occupants of the passenger cabin have no toxic fume protection whatsoever nor are there any instructions available for what the passengers should do. It is literally no different than being in a fully occupied theater and after discovering a fire, finding out that all the doors are locked and there are only a couple of buckets of water to extinguish the fire . . . the person who has the keys to the locks will be back in twenty or thirty minutes! The reason there is so little fire fighting equipment available in the passenger cabin is largely because of the toxic and/or oxygen depriving nature of the fire extinguishing components. In other words, very useful and meaningful fire extinguishing equipment unfortunately also pose a life threatening hazard to the occupants. The FAA and industry for years, have been caught in a vicious "Catch 22" dilema. Although the FAA in the past has attempted to address the issue of toxic fume protection the practical and technical solutions then afforded have been deemed inadequate. Too costly, too complex, too hazardous or not meaningful enough. Xenex Corporation, has developed systems that overcome all the previous objections and, in fact, provide an unlimited duration of breathable air for passengers as well as crew. The system can be implemented immediately for 80% of the nation's passenger seats without modification to the aircraft. Implementation can be accomplished without taking the aircraft out of service. The other 20% requires some minor modification which can be readily accomplished in the course of regular servicing of the aircraft.

Xenex is now in a position to produce the PELS. For several years Xenex Corporation has worked within the system in order to accomplish a uniform industry adoption of toxic fume protective breathing equipment. This we felt would be in the best public interest. Needless to say, the wheels of progress turn slowly. Today, after more than two decades of knowing of the asphyxiation problems there is neither instructions nor safety equipment available to passengers in the event of inflight fire, smoke and toxic fume emergencies.

We have developed a PELS unit with universal adaptor, which can be fitted on any common air outlet and thus be sold directly to the public. Anyone who wishes can carry their own equipment onboard an aircraft. We have refrained from pursuing this course of action. The reason: we feel it is the responsibility of the FAA to attend to these basic safety matters thru the regulatory process. Advertising our products on radio, television or in the press would most certainly alarm the public to the detriment of the industry. Nevertheless, in the absence of prompt regulatory action, we will pursue this course as soon as possible. Further delays, depriving crew and passengers of their right to life saving equipment, are improper and not justifiable.

The FAA has in the past prepared rule making requiring toxic fume protection for passengers. The most prominent effort was in 1969–70 under Notice 69-2, docket number 9344. Unfortunately, the technology available at that time was not suitable and did not provide "meaningful protection". The effort at that time was misdirected to addressing the aircraft crash problem. The discussions on 69-2 centered on donning a protective breathing device after a crash. That is analogous to putting on your seat belt when you discover your about to crash your car on the freeway! Many objections were raised about the increased evacuation time attributed to putting on the hood after the crash, but prior to evacuation. At that point it is obvious the main thing is to "get out" whether or not you have a hood. Nevertheless that issue is rather moot. As mentioned before 90% of all aircraft fires are inflight. What is needed is toxic fume protection so that the fire can be fought with meaningful fire extinguishing equipment—not "a couple of buckets of water". In turn this will help the passengers to stay alive long enough so they later may have a chance to evacuate!

The most recent rule making proposal requiring toxic fume protection for passengers (¶ 120.69 (a)(8)) was issued by the FAA in September/October last year as an inclusion in the Rules by Objective. These proposed rules were withdrawn by the FAA two weeks ago. We look forward for prompt reintroduction of same.

There is no question that the problem is real. The pilots have toxic fume protective breathing equipment. They know how serious the problem is. As a matter of fact the Airline Pilots Association has been on record for more than a decade advocating such protection also for flight attendants and passengers. Likewise, the Flight Safety Foundation, to which virtually every airline in the free world belongs, recognizes the need for such equipment. By virtue of FAA regulations for the cockpit crew, there is acknowledgement and recognition of the life threatening hazards confronting all passengers and crew aboard aircraft—not just the pilots. Common sense tells us that flight attendants and passengers deserve equality under the law. Furthermore, experience shows us that the regulation (law) as it applies to the pilots is outdated and insufficient. (The regulation referred to has been in effect since the piston age era). The regulation calls for 15 minutes of protection, hardly enough to even get the plane on the ground in best of circumstances. (In the Air Canada disaster, it was most fortunate that the aircraft was very close to a suitable airport.)

Based on experience obviously a regulatory requirement for an unlimited duration of respiratory protection would be best. Especially when the technology exists to provide same without any added cost, weight or loss of space. Nevertheless minimum requirements over land should be ½ to 1 hour and on overseas flights there should be enough toxic fume protection to reach the nearest suitable airport from any point of the "over ocean" sector.

A few other matters concerning "smoke hoods" deserve attention, one of which is visability thru the hood when it is worn. A decade ago when this was a topic of discussion, certain groups were advocating the dangers of wearing smoke hoods because of the potentially impaired visability. This argument is in face of known facts and common sense nothing but unmeditated nonsense. The fumes that are known to occur in aircraft fires can have devastating effect on the eyes to the point of blinding those exposed. Plus, in most cases, the smoke is so thick you can not see your hand in front of your face even with a smoke hood with 100% transparency. Even in the case of the Air Canada disaster, the smoke evacuation equipment which by regulation is provided for the cockpit (not the passenger cabin) was inadequate to enable the pilot to properly see to land the plane. The main function of a smoke hood is to keep people alive and protected against toxic fumes. They are not designed nor will they function to give the wearer x-ray vision to watch the scenery or the movie thru the unpenetrable smoke!—Nor can this, as some advocates seem to think, be accomplished without the hood!

Another matter of concern has been "the dangers of suffocation" when using smoke hoods. We all know that there are some people who either do not pay attention to emergency instructions, or are unable to perform what they have previously learned when an emergency arises. We, and the FAA, based on it's previous testimony on this topic, consider these risks to be minimal. If one were to accept the argument that smoke hoods should not be used, because improper use may cause suffocation, then we should ban cars, aircraft, boats, bicycles, alcohol, aspirin, etc. etc. and not get out of bed because of risks associated therewith!

The simple facts are that we need toxic fume protection on board aircraft. There may be someone, who for whatever reason, uses the equipment improperly. This should not serve to deprive all those who can and will use the equipment properly of their right for reasonable and meaningful life safety equipment for their survival in the face of known life threatening hazards.

The problem of fire, deadly smoke and toxic fumes on board aircraft should be addressed from the standpoint of providing appropriate and meaningful fire extinguishing means. Because meaningful and potent fire extinguishing agents are mostly toxic or oxygen displacing, thereby posing a life threatening hazard to crew and passengers, this cannot be accomplished without providing toxic fume protection for crew and passengers. The Xenex PELS systems were developed for this purpose as well as, of course, to provide protection against the smoke and fumes eminating from a fire.

In addition, there should be an ongoing effort to reduce the flammability of cabin interiors Please carefully note, however, that it is not possible to create a fire or smoke-proof aircraft even if you made the seats and interiors of stainless steel. Why? Because luggage, cargo, clothing and fuel also pose lethal hazards in themselves.

I will take the liberty to quote a few of the horror stories from a recent issue of SAFE Journal. "For example, hydrochloric acid that has been packed in a tile company employee's checked luggage leaked. It was discovered when the resultant smoke was seen coming from the baggage compartment. In another, an employee of a rocket manufacturing company packed live rockets in his suitcase and checked it through to his destination—a goverment firing range. . . . A flammable cleaning solution leaked from a bag checked by a ski lift contractor. A package checked as baggage, containing 20 pounds of liquid fiberglass hardner, was on fire when baggage handlers unloaded the aircraft cargo compartment. Flammable corrosive samples in a salesman's carry-on luggage leaked and filled the aircraft cabin with an offensive odor. A passenger accidentally spilled a water reactive chemical from his brief case on his newspaper. He asked flight attendant to place newspaper in a bucket as it would ignite if it became wet. Gasoline samples, being taken to a testing laboratory, leaked from an oil company employee's luggage. A salesman checked baggage containing 2,000 rounds of 38 caliber ammunition."

Currently hijackers are using flammable fluids and cigarette lighters to hijack planes. This futher accents the need for toxic fume protection and improved fire extinguishing means.

I am glad to see that the FAA has seen fit to require improvements in cabin materials. I trust the other two vital areas in this serious aviation safety issue are also part and parcel of the FAA's efforts, namely improved fire extinguishing equipment and toxic fume protection for passengers.

To merely address the matter of improved fabrics is like saying that we will improve the fire resistant materials in buildings but—we will not provide sprinklers, firehoses, smoke alarms or a fire department. Nor, will we provide any meaningful way of venting the smoke or evacuating the building! This is unthinkable in our daily non aviation environment.

The 301 asphyxiation victims in the Saudia disaster along with the 23 fatalities in the Air Canada disaster, plus several hundred more in other recent tradgedies, stand as painful testimony of the need for meaningful fire extinguishing agents and toxic fume protection. To ignore these serious safety issues any longer should not be permitted.

The problem is: in many disasters 100% of the fatalities are caused by asphyxiation. The solution is: to deal directly with the problem by providing toxic fume protection now—anything less would be irresponsible to contemplate.

The cost for implementing toxic fume protection and appropriate fire extinguishing means will not exceed 15¢ per ticketed passenger. This, I submit, is cost effective in the mind of any person expecially those who aware of the life threatening hazards that currently exist. I need not remind you that cost effectiveness or cost benefit analysis has been discussed endlessly in the past. The only cost benefit analysis that means anything is what the public is willing to pay for its own safety. I submit that there is not one air traveler around who would not accept a cost of 15¢ on their ticket, which in many cases, costs hundreds of dollars, for the purpose of dramatically improving their chances of survival in the event of disaster. Certainly the 23 unfortunate souls in the Air Canada disaster could have been saved had they not been overcome by toxic fumes. Moreover, it is my considered opinion that the public mistakenly believes that the protection is already in place and they are already paying for it.

In order for us to properly assess and compare aviation safety in perspective and relation to other areas of safety, we must have a common measurement. For instance, comparing aircraft with busses, trains, subways, cars, ships and hotels would seem most appropriate. This cannot be fairly or properly accomplished if we resort to measuring distance or counting take-offs and landings. This however is the current practice. In other words, in aviation you count the number of passenger miles or take-offs and landings between fatalities. That's like counting the number of footsteps hotel guests complete collectively per asphyxiation fatalities or the number of times the doors open on busses in relationship to buss fatalities. We think this is wrong. In fact it invokes a false sense of security not only to the detriment of the industry in the long run, but also to the public.

There is nothing better than cold hard facts and honest competition if one is to assess safety and accomplish improvements. To meet this objective, we must have common measurements. In our opinion it would be most appropriate to insert in the consideration, factors of time and inventory, That is, how long is one or a group of people exposed to flying, driving or staying at hotels, and what is the percentage of the inventory of structures and/or vehicles involved for instance in asphyxiation fatalities, heart attacks, fires, etc. This enables us to compare the safety hazards of spending one hour on a plane on a boat or a train. Likewise, we can then also determine how many of the total invetory of aircraft or busses or hotels are annually involved in fires or asphyxiation fatalities for example. By so doing, we will be better equipped to improve and evaluate our safety records in a meaningful manner.

We are cognizant of the read-justment that the airline industry has been forced to make as deregulation has become a reality. Many, but not all, airlines are now in dire financial straits. Obviously, it can be argued that if they cannot afford to provide minimum or reasonable safety protection then that really should not be in business.

In order to expedite the implementation of appropriate safety equipment, I would encourage the members of this Committee to investigate the possibility, for instance, of an interim tax per ticket in order to assist the airlines in funding an expedient improvement in the areas of aviation safety. The tax need merely be in effect for 12 or 24 months in order to accomplish the objectives. The installation of x-ray machines and similar security measures at airports were accomplished in a similar manner.

In support of my testimony, we have submitted several hundred pages of references and supportive data with this prepared statement. Should the Chairman require additional documentation in specific areas, we will be pleased to submit same at your rquest.

I trust that the testimony submitted by Xenex Corporation will be of value to the Committee and that in light of the overwhelming preponderance of evidence immediate action will be taken to remedy what is now recognized as outdated and/or non-existent regulations as well as safety deficiences. In the interest of public safety and maintaining a superior U.S. aviation industry, I am sure that the rest of us in industry and the FAA are in agreement with this course of action.

Again, thank you for the opportunity to present this testimony. I will be pleased to answer any questions the Committee members may have.

Mr. LEVITAS. Thank you very much, Mr. Werjefelt, for your testimony.

As I said, the entire document will be made part of the record. I have some questions and I am sure other members do as well. You had indicated earlier that you had a video presentation that you wanted to make available to us. There is a vote in process on the floor at this moment, and I suggest, that we recess very briefly so members can go vote on this matter. When we return, if you are set up with your video, we can proceed with that and then get into the questions.

That being the case, the subcommittee will stand in recess for 10 minutes.

[Recess.]

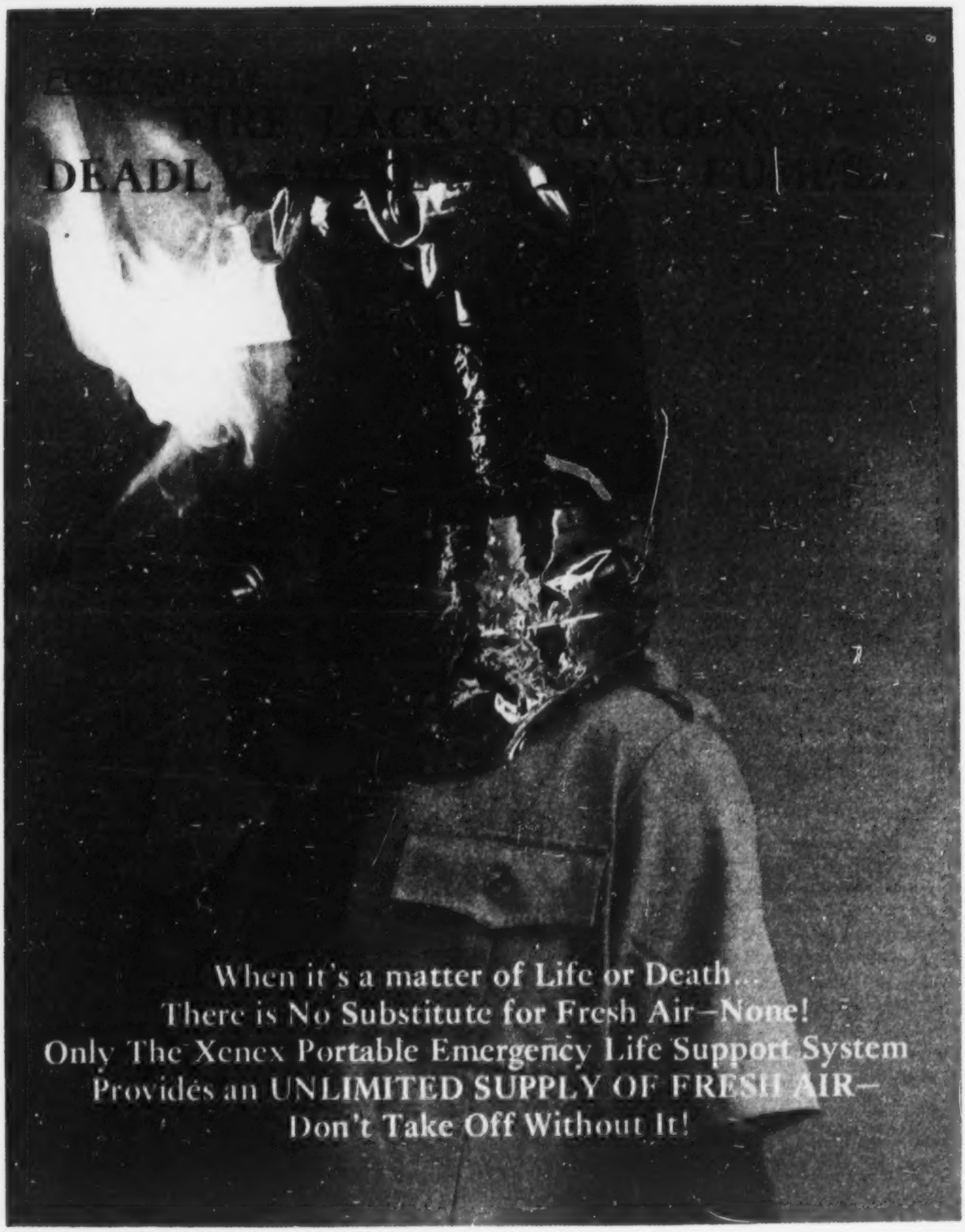
Mr. LEVITAS. The subcommittee will please come to order.

Mr. Werjefelt, if you are ready now with the video. May I suggest that you get one of the microphones off the table there, and use it to speak into, if you have any explanation. Is there sound on the video?

Mr. WERJEFELT. Yes.

Mr. LEVITAS. You might want to get one of those mikes and hold it next to the monitor as well. Is there any reason why you can't turn that so the audience might see it, also? Fine.

[The following was received from Mr. Werjefelt:]


FIRE, LACK OF OXYGEN
DEADL
FUMES

When it's a matter of Life or Death...
There is No Substitute for Fresh Air—None!
Only The Xenex Portable Emergency Life Support System
Provides an UNLIMITED SUPPLY OF FRESH AIR—
Don't Take Off Without It!

The XENEX PELS...

THE FACTS AND THE PROBLEMS

Aviation safety, with all the facets it entails, is the fundamental building block for today's air transport industry. The continued improvements in safety are directly related to the growth and health of the industry. This is a well known axiom to air transport industry management.

One of the most serious and life threatening hazards which can confront flight personnel and passengers is aircraft fires. According to Gerard M. Bruggink, former Deputy Director, Bureau of Accident Investigation, National Transportation Safety Board, **"Incidents involving smoke or fire should be treated as critical from the very beginning**. When the origin of smoke or fire is unknown, and when checklist actions fail to identify and correct the problem, land as soon as possible or bring the aircraft down to a level from which an immediate emergency landing or ditching can be made. If this sounds like grim advice, consider the alternatives..." and with that Deputy Director Bruggink recites two occasions where aircraft occupants were asphyxiated by in-flight smoke in a matter of minutes although the emergency landings left the aircraft intact and were thus survivable.

How serious are the problems relating to aircraft fire, explosion, smoke and toxic fumes? Very serious indeed. The United States Senate Subcommittee on Aviation recently held a hearing concerning Airliner Cabin Safety and Health Standards. It was revealed that in little more than a five year period preceding the hearing there had been more than 3,000 occurrences on U.S. transport aircraft, according to FAA records. It was also revealed that the **"SAFER Committee"** which comprised"... approximately 150 of the world's top experts in fire research, operations, accident investigation, materials, developments, systems design and aircraft fire and occupant safety..." **recommended "immediate action" to "reevaluate use of personal protection devices against toxic fumes and flames." The FAA is aware of the problem and has subsequently included in proposed rulemaking Par. 120.69 that all passengers and crew be provided protection against smoke and toxic fumes.** The FAA has done so for good reasons. According to testimony by industry officials **90% of all aircraft fires occur in flight where, in fact, crew and passengers are virtually helpless** in contrast to a similar emergency on the ground. In fact, it has been demonstrated, and also was revealed to the committee, that toxic fumes in aircraft fires are so poisonous, and the capacity to evacuate the smoke and fumes from the aircraft are so poor, that persons breathing the smoke and toxic fumes can receive an irreversible lethal dose in less than a minute. In one recent period of a little more than a year, it is estimated that more than 600 people have been asphyxiated on board American made aircraft because of smoke and toxic fumes. In one incident alone more than 300 people were asphyxiated even though the aircraft landed normally on a runway.

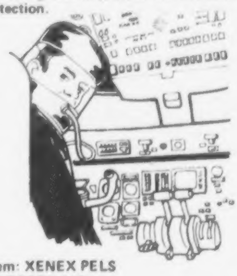
Although there are some regulations governing fire and smoke protection for cockpit crews, these regulations are relics from the piston age era of aviation and, as was pointed out during the Senate inquiry. A good portion of the regulations do not address the real life circumstances existing in today's jet age environment. For instance, it is well known, based on research conducted by the FAA, the Civil Aeromedical Institute, the British CAA, and other government and industry sources that the vast majority of fatalities relating to aircraft fires are caused, not by fire (itself) but rather the inhalation of smoke and toxic fumes. along with oxygen deprivation.

Current regulations governing the safety of cockpit crews dictate a minimum reguirement of 15 minutes of 100% oxygen as protection against smoke and toxic fumes for each cockpit crew member. In addition, there shall be capabilities for smoke evacuation from the cockpit, within safe pressurization limits. Time and again it has been demonstrated that 15 minutes of protection is woefully inadequate and, has not, in many cases, even been sufficient time to land the aircraft. There have been no regulatory requirements nor equipment for protection of flight attendants or passengers againt smoke and toxic fumes. **Incorrectly many people, public and professional, have assumed that aircraft passengers oxygen masks provide smoke protection - they do not - in most cases they won't even be deployed in a smoke or toxic fume emergency.**

It is now well recognized that meaningful smoke and toxic fume protection should be on the order of minimum one hour, more for trans-ocean flights. The reasoning for this is based on the fact that many in flight smoke and toxic fume circumstances originate from hazardous cargo or luggage which in themselves may pose no threat to the safety of flight whereas the fumes eminating therefrom pose a life threatening hazard to the passengers and crew. Therefore, it is obviously important to provide sufficient protection to facilitate landing the aircraft at a suitable airport rather than proceeding with an emergency landing with its inherent risk of disaster. In order to provide meaningful protection, the old state of the art carried with it a weight penalty on the order of 20 to 30 pounds per passenger and crew members. On a heavy jet, for example, this would mean the equivalent of approximately three LD3 freight containers (at least 9,000 or 10,000 pounds) devoted to providing toxic fume protection.

For many years there have been a variety of smoke hoods, gas masks and filtering devices on the market some with small high pressure oxygen or air cylinders, others with chemical oxygen generators. The effective duration of protection commonly ranges from less than a minute to 15 minutes. The reasons we don't find these masks, hoods, or filtering devices installed in aircraft (or high rise structures for that matter) is because of the less than meaningful protection afforded by such devices, i.e. what good is it to filter air, removing the toxic components when in most fire and smoke situations there isn't enough oxygen in the air to sustain life! If these devices would provide meaningful protection then obviously pilots and professional firefighters would make use of them - **they don't - for good reasons.**

Meaningful protection against smoke, toxic fumes and concomitant lack of oxygen is recognized in professional circles to mean several hours of protection.



*PELS for use
by pilots,
flight attendants
...and passengers.*

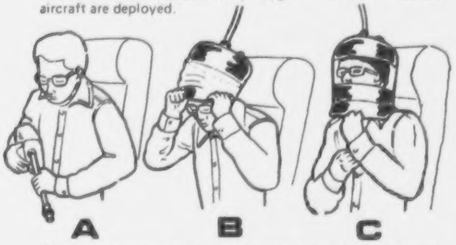
The Solution to the Problem: XENEX PELS
UNLIMITED SUPPLY OF FRESH AIR

The Xenex Portable Emergency Life Support System (PELS)* is a fundamental method for providing an unlimited supply of fresh air to flight crews and passengers. Fresh air is one of the three basic criteria inherent to safety during smoke and fire emergencies. fire warning means (smoke alarms), fire extinguishing means, and **fresh air.**

In a smoke or toxic fume emergency, the Xenex PELS System provides a user with an unlimited supply of fresh air by sound technological means, far exceeding physiological requirements. **The Xenex PELS provides a continuous flow of fresh air. You have all around visibility, you can hear, speak and breath normally, all of which are vital during emergency situations, especially for pilots and flight attendants.**

Portable Emergency Life Support System

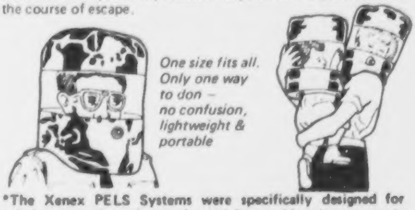
The Xenex PELS unit is easy to use - it only takes seconds to put it on. So, when time is of the essence, when every second counts, when it is a matter between life and death, the Xenex PELS System will provide an unlimited supply of fresh air. You merely **remove the PELS unit from its storage container and put it on. That's it. No belts, straps, valves to turn, cartridges to activate, or alarms telling you the air supply is exhausted. Just put it over your head and connect it to the continuous fresh air supply. It's as easy as A-B-C! The Xenex PELS System can also be automatically deployed,** in the same manner that the supplementary oxygen masks now in use on aircraft are deployed.



When others measure their equipment in pounds, our's is measured in ounces. The basic **Xenex PELS System ranges in weight from approximately 6 to 14 ounces per individual unit,** depending on the aircraft it is installed in.

The PELS unit is omni-directional. There is only one way to put it on. You can't put it on backwards. No confusion. It fits all head, face and neck sizes. Long hair, glasses or beards will not diminish its performance. The fit is universal - one size fits all - adults or infants - a vital consideration in a toxic environment.

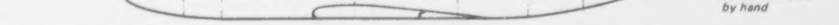
The Xenex PELS Systems are portable. When you disconnect from the continuous supply source the 26 liter hood (20 liters net) provides a portable air supply lasting from 2½ to 8 minutes.* Moreover, your Xenex PELS unit can, at any time, be rejuvenated in the course of the emergency by merely reconnecting it to the air supply outlet. **Combining the features of an unlimited supply and continuous flow of fresh air with portability is vital from the standpoint of providing meaningful protection.** Thus, even though you may confined for hours in a toxic environment this does not pose a limitation on the Xenex PELS System (in contrast to other systems and equipment). Yet, when time comes for evacuation or escape the Xenex PELS System is portable and provides for protection in the course of escape.



One size fits all. Only one way to don – no confusion, lightweight & portable

***The Xenex PELS Systems were specifically designed for aviation use,** where the smoke and fire problem is more acute and dangerous than anywhere else. The Civil Aeromedical Institute, Oklahoma City, Oklahoma, USA has tested and verified that a 20 liter supply of air is sufficient to provide 2½ to 8 minutes of protective breathing (i.e. when the Xenex PELS is disconnected from its supply source). This portable air supply exceeds the maximum time of 90 seconds for emergency evacuation (when an aircraft is on the ground or in the water).

Individual Xenex PELS units are made of Kapton®, a fire resistant polyimide film manufactured by Dupont. Kapton is used in many aerospace applications because of its superior fire resistance and other qualities. The tensile strength of Kapton is 25,000 to 30,000 psi, the equivalent strength of some metals and it maintains its unique properties over a temperature span of 800°F (-380°F to +400°F); It can withstand open flames (approx. +1200°F) for short durations. Kapton is used extensively for protection of satellite and spacecraft components exposed to the extreme environment of outer space. Most aircraft electrical wiring is insulated and fire protected with Kapton. Vital portions of the Xenex PELS unit have an additional heat reflective aluminized coating over the Kapton, to further inhance safety.



Automatic Drop System... where 'PELS' drop by actuation from pilot, flight attendant, fire or fume dectection equipment.

Manual System Each passenger connects 'PELS' by hand

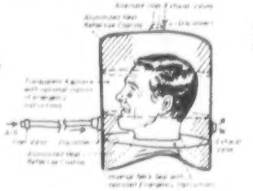
Typical Aircraft Installation

The Xenex PELS Systems are cost efficient. It is very simple to retrofit an aircraft with the Xenex PELS System. Approximately 75% of all transport category aircraft, utilized by common carriers, can be retrofitted with the Xenex PELS System in the course of regular scheduled servicing. These aircraft **do not** require an STC for the installation of the Xenex PELS System. The individual units are stored underneath the seats or in the overhead racks. the user activates his or her individual unit by merely connecting it to the fresh air outlet, or when the PELS is automatically deployed (requiring STC) the user merely dons the PELS.

The total cost of the Xenex PELS System has been estimated by one airline at less than 2¢ per ticketed passenger. This cost estimate includes fuel penalties for carriage of the PELS equipment and also takes into account the shelf life of the equipment and average load factor of 50% to 60%. Costs will vary depending on type of aircraft installation and type of operation.

The XENEX PELS...
Portable Emergency Life Support System

FEATURES:
- Lightweight
- Continuous air flow
- Portable
- Full view
- One size fits all
- Fire resistant


Aluminized Heat Reflective Coating
Air
Aluminized Heat Reflective Coating
Exhaust Valve

USE: Offices, Hotels, Hospitals, Factories, Aircraft, Ships, Mines, Nuclear Generating Plants, Oil Drilling Platforms...
Military: Aircraft, Buildings, Ships, Missile Silos & Areas, Personnel Carriers, and other dangerous areas...

Following is a list of some of the common lethal gases associated with aircraft fires and their lethal concentrations.

Gas	Lethal Concentration
Hydrogen Fluoride	One part in 20,000
Hydrogen Cyanide	One part in 5,000
Nitrogen Dioxide	One part in 5,000
Sulphur Dioxide	One part in 2,500
Hydrogen Chloride	One part in 1,000
Carbon Monoxide	One part in 200
*Carbon Dioxide	One part in 10

*One part in 50 has proven lethal in animal tests

At these nominal concentrations even a few breaths are lethal. Death results after a few seconds, minutes at most.

Lightweight & Compact...

Universal Neck-Seal...

Expandable opening...

Easy to Don...

Complete Protection...

SPECIFICATIONS:

Type of Unit:
Open/closed circuit, low pressure compressed air, air line/self-contained breathing apparatus.

Duration:
Unlimited, from air supply source - (2½ to 8 minutes when operated as self-contained breathing apparatus - CAMI** 20 minutes with optional O_2 generator)

Weight:
6 to 14 ounces

Operating Pressure Requirements: Low pressure
Hood pressure 1.5" to 3.0" of H_2O (tapped from aircraft air duct system) PELS inflow valve, activated or deactivated by normal hand pressure.

Air Flow:
3 to 4 cfm

Temperature Range:
Storage -380°F to +400°F Operation: +650°F;
Open flame short duration (approx. +1200°F)

Equipment Shelf Life:
In excess of ten (10) years when properly stored.

Materials:
1 and 2 mil Kapton® polyimide film with 250 Å aluminized coating. Silicone neck seal (thickness 12 mil). Valve components aluminum. Hoses: material optional

Hood Capacity:
26.07 liters, minimum avaiable air space 20.0 liters.

Neck Seal:
Silicone with 2½" opening; Expandable to 13" Diameter

Compressed Fresh Air Source:
Turbine bleed air; existing air compressors; ram air duct; or optional separate compressor for use with PELS only.

Deployment:
Optional manual or automatic.

Radiation Exposure Qualities:
Still functional after continuous exposure to 10^8 RAD.

**Civil Aeromedical Institute

Methods, Systems and Equipment Patents Pending
© 1983 Xenex Corporation.

NOTE: Kapton is a registered trademark of The Dupont Company

For complete information please contact:

XENEX CORPORATION
1400 Kapiolani Blvd. • Suite C-4 • Honolulu, Hawaii 96814 U.S.A. • Telephone: 941-1177 • Telex: ITT 7430496 (XENEX)

1983 Xenex Corporation, 1400 Kapiolani Blvd., Honolulu, Hawaii • Printed in Hong Kong, All Rights Reserved.

Mr. LEVITAS. Thank you very much, Mr. Werjefelt.

What is the cost of one of those units that you displayed there?

Mr. WERJEFELT. The cost, depending on the hardware that is involved in it, ranges from, say, $80 to $300 per unit.

Mr. LEVITAS. Several years ago, I saw a demonstration of a hood of that sort without the outside air source connection, and they said it contained about 3 to 8 minutes of air inside, as does the one that you demonstrated in that video tape.

Are you familiar with that mask system?

Mr. WERJEFELT. Very much, yes.

Mr. LEVITAS. Obviously, it does not have the same utility that this system which you just described in your video would have. But in terms of an emergency evacuation piece of equipment, does that hold any possibilty of improvement over what we have today?

Mr. WERJEFELT. My personal philosophy on emergency evacuation is: unless you have it on when it happens, there would be some people who probably would have the dexterity and wherewithal to put it on. But it is like putting on your seatbelt when you see your car is going to crash. There are some situations where we would be hardpressed to find any protection.

In the case of Air Canada, sure, they had plenty of time to don protective breathing equipment.

Mr. LEVITAS. Some of the arguments that are given by FAA in not promulgating regulations requiring emergency breathing equipment, smoke hoods and the like, is that people wouldn't use them, that they would have difficulty in dealing with them, that it is too complex and complicated, and that there was just a general fear of putting something over your head of that sort.

What is your experience, or what do your studies show with respect to matters of that sort?

How complicated is it? How much instruction would it take?

Mr. WERJEFELT. It is an evolutionary thing, I would say. This system is something that can be implemented now, starting this year.

Ultimately, of course, you want to see an automatic system which drops down, combining the oxygen with the fresh air supply into one unit, which this one does. It provides better decompression protection than what is presently available because it retains the oxygen rather than loses it.

As to people donning it, I think when it is automatically deployed, they would have an easier time doning this than the present oxygen mask. There is only one way to put it on.

We have seen very little difficulty with that.

Mr. LEVITAS. I might interrupt you at that point. I remember several years ago we had some testimony about instructions and the use of oxygen masks. Based on some film footage, we saw, as well as some testimony, it was very interesting to me that apparently many intelligent adults couldn't get it on right.

Frequently people would put that oxygen mask we see demonstrated every time we fly over their mouth and leave their nose out from underneath the mask or wouldn't pull the cord that would release the oxygen in some of these situations.

So, in this case, by putting it over your entire head, you avoid the possibility of a misuse of the oxygen equipment we presently see. Is that correct?

Mr. WERJEFELT. No question. Absolutely.

Mr. LEVITAS. I interrupted you.

Mr. WERJEFELT. No.

Mr. LEVITAS. Tell us a little bit about your company, Xenex Corp. I accept the fact that you are not here trying to sell the product. You are simply identifying one example of the technology that is available and if it had been in place last month, then 23 people would still be alive today is essentially the story you are telling us.

But I would like to know a little bit more about the Xenex Corp. How long has it been in existence? What other products does it make?

Mr. WERJEFELT. Well, Xenex Corp. has been in business for 6 years. We devote ourselves to proprietary research in the areas of nuclear physics, electromagnetic energy conversion systems, photocatalytic systems.

These are the things that actually brought us into this area. We had developed a photocatalytic system for the attenuation of ozone onboard aircraft so it could be done more economically than present methods. We have also worked on the ventilation system for providing more fresh air on the aircraft without increasing the cost for so doing.

The proprietary work that we do develop goes out for license to other companies. We fund ourselves on limited partnerships on various of these ventures.

It is a big risk and a long one at that. Some of these developments take half a dozen or more years to get from conception to market. I hope that answers your question.

Mr. LEVITAS. The testimony yesterday and the day before indicated that on the Air Canada aircraft the emergency breathing equipment provided for the flight crew didn't function properly; that the smoke and fumes got inside and the goggles were clouded up or made unusable.

The pilot had to take the goggles off and try to clean them. What about the type of emergency breathing equipment you have just described for us? How would that compare to what was available on the Air Canada?

Mr. WERJEFELT. Needless to say, we worked extensively with some of the people at the Civil Aeromedical Institute in the survival and life support laboratory they have there, pinpointing the exact details of what we wanted out of this design.

Some of the things you mention about the mask leakage and goggles fogging up and so on, those are not new. They are long-term problems. They have existed for a very long time.

I can recall, I think it was after the 1973 accident they had in Boston, a smoke-filled cargo plane, they were looking again at smoke goggles and smoke masks.

I think they went through 130 different goggles and masks and found of those, three or four that had a qualified fit for the user. Face sizes are so different that it is very difficult to get something that will fit properly when you are talking about hydrogen cyanide, hydrogen fluorine, very, very toxic components.

It is imperative they fit properly or that you have a positive pressure system. Many of the masks they use in the cockpit are demand oxygen masks. Same thing with the goggles, it is imperative they fit properly.

It is a perennial problem. We believe what we have developed will overcome that problem, in addition to providing an appropriate duration of protection for the pilots.

In the Saudi example I gave, they ran out of oxygen. The critical thing, of course, is visibility and survivability for the pilots.

Mr. LEVITAS. What about the question of visibility and sight? Are you working on anything that would improve the visibility for the pilot in a smoke-filled environment?

Mr. WERJEFELT. Yes. We have what we consider to be a very simple answer to a long-term problem. No matter how much smoke evacuation equipment that has been put in for the cockpit, it never seems to be enough.

Obviously, it will never be enough in the passenger cabins based on that. We have a system now that will provide full visibility, certainly visibility outside the cockpit, 100 percent, and visibility of vital instruments to the pilots no matter how much smoke is in the cockpit.

Mr. LEVITAS. You already have that technology?

Mr. WERJEFELT. We can have some equipment out of the lab, I would say, in 60 days.

Mr. LEVITAS. In 60 days, did you say?

Mr. WERJEFELT. Yes.

Mr. LEVITAS. Do you have sketches or drawings that might indicate what this looks like?

Mr. WERJEFELT. Sure.

Mr. LEVITAS. Could you submit that to us?

Mr. WERJEFELT. Do you want them now or later?

Mr. LEVITAS. Well, if you have got them with you it would be helpful for us to take a look at it.

Mr. WERJEFELT. Yes.

Mr. LEVITAS. Thank you.

Mr. WERJEFELT. Perhaps I can just provide some comments to you as you are looking at it. The system is very simple.

It provides for an inflatable bag, preferably of the same material as you have seen here in the video presentation. The bag inflates with onboard pneumatic air supply and provides then a transparent cushion between the pilot and the cockpit window or the instruments.

As long as the pilot is flushed up against it, he will see whatever he wants to see outside or inside the cabin. It is a very simple solution to a 40-year-old problem.

Mr. LEVITAS. In other words, you could use it either with the present emergency breathing equipment that is being used, or in combination with the type of smoke hood and breathing system which you have demonstrated on your video; is that correct?

Mr. WERJEFELT. That is correct.

Mr. LEVITAS. Just putting it very simply, as I see what you are talking about, this bag deploys and creates an environment within this contained area of deployment that is pushed up against the instrument panel and the windshield, and then the pilot, the flight crew, puts their face right up against it so, therefore, there is no smoke inside that area.

Mr. WERJEFELT. That is right. It essentially moves the instruments and window up to his face.

Mr. LEVITAS. You believe that this technology is on the verge of being available?

Mr. WERJEFELT. Oh, we are going to make sure it is. We have discussed it with the foremost experts in the specific area of cockpit smoke evacuation.

They fully condone it, support it.

Mr. LEVITAS. The type of emergency breathing equipment that you demonstrated on the video, if that had been in place on the Air Canada flight, then the people who died from the smoke and fumes would still be alive?

Mr. WERJEFELT. From what I have heard, I am firmly convinced of that. I think some of the witnesses, or Mr. Grubbs, I met him briefly. He felt the same way.

Mr. LEVITAS. Have you ever discussed with FAA the possibility of requiring or providing these types of systems on aircraft?

Mr. WERJEFELT. Yes. For a long time.

Mr. LEVITAS. Tell us what your experience was when you have talked to FAA about that? What response did you get? Who did you speak to? How many, just roughly?

Mr. WERJEFELT. It goes back 3 or 4 years, I guess. Again, it relates to the overall systems we have been working on. It is not just limited to the toxic fume area, but also includes ventilation of the cabin for health reasons, et cetera.

Included in that was the toxic fume issue. We filed a petition for rulemaking with the FAA. As I recall, I personally wrote a letter to Langhorne Bond inquiring whether or not the toxic fume issue would be addressed under the petition.

I got a letter back from one of the staff, and they assured me that such would be the case. Subsequently, the petition was denied and not a word was mentioned of it anywhere, either in the denial or anywhere else.

After that we have been in contact with the FAA. I think we spent 2 years trying to find a way to get permission to put the device you just saw on board a plane, even though it is totally harmless.

We were supposed to go through supplementary-type certification procedures, which is what you use when you get new engines on a plane. It is a long song.

I think, however, at this point there is obviously something that is going to happen.

Mr. LEVITAS. But the bottom line is you got no response from FAA. Did you ever get any explanation of why they denied the petition and took no action on this?

Did they give you their reasons?

Mr. WERJEFELT. No. As a matter of fact, at the time of the denial of the petition, we didn't see at all eye to eye. Their lack of any mention whatsoever of the toxic fume issue, coupled with the other things, prompted me to go to our Senator from Hawaii, Senator Inouye. He had a hard time believing what was going on.

It took us, I guess, another year or so until we made some headway on it—had a hearing, et cetera. Some of the matters came out there.

As for the toxic fume protective breathing equipment, I believe it was something on the order of 2 years when we finally ran out of patience and wrote a letter to the FAA asking them to clarify the issues.

What are the procedures for getting this on a plane? We finally got the procedures, but there is still no regulation, which renders it a rather moot issue.

Mr. LEVITAS. But you have never received any explanation of the reasons that FAA has for not implementing certification of this?

Mr. WERJEFELT. No.

Mr. LEVITAS. Did they ever tell you privately, off the record, what the reasons were?

Mr. WERJEFELT. No. I can't say that, other than that is the usual bottleneck.

Mr. LEVITAS. It would be helpful if you could supply us with copies of your correspondence with FAA back and forth on this matter. It might give us some insight or at least a starting point as we begin to ask these same questions.

[The information received from Mr. Werjefelt follows:]

XENEX CORP.,
Honolulu, HI, August 23, 1983.

Re: Supplemental materials requested concerning "passenger safety and survivability in airline cabins", hearings July 12-14, 1983—implementation of toxic fume protective breathing equipment.

Hon. ELLIOTT LEVITAS,
Chairman, Subcommittee on Investigations and Oversight, Committee on Public Works and Transportation, Rayburn House Office Building, Washington, DC.

DEAR CONGRESSMAN LEVITAS: Subsequent to my appearance at the hearings referenced above, I had occasion to discuss with an official of the FAA what their immediate and near future direction would be on the issue of toxic fume protective breathing equipment for passengers and crew. To my astonishment I was informed that the FAA did not perceive that there would be any regulatory effort extended by the agency as a result of the Air Canada disaster.

You may recall that in my prepared statement I advocated a conciliatory posture between all parties. In other words, stop pointing fingers and start accomplishing improvements in these critical aviation safety areas. However, I must retract my conciliatory position. The callous attitude and neglect displayed by FAA management deserves to be contested with the utmost vigor. To do otherwise would merely serve to condone the apalling actions by the agency. In this regard, I must say that I admire you for your perseverance to force the FAA to attend to the many serious safety issues which the agency seems to neglect or even totally ignore.

Per your request for additional information why the FAA has not implemented toxic fume protection on board aircraft and what difficulties we have had concerning the implementation of our PELS systems, we have attached what we consider the most brief and descriptive documentation on the problem. The documentation demonstrates what we believe is a concerted effort by the FAA to obstruct implementation of any new systems or other improvements. We have several hundred more pages of communications to the FAA which document the problems and, in turn, the FAA's "do nothing attitude".

A system such as described in the video presentation during the hearings may finally be used on aircraft. However, as you know, and I surmise you agree, the ultimate objective is for a system which is automatically deployed. This, according to FAA, requires "type certification" or a "supplemental type certificate". These certificates are costly and cumbersome and are usually applicable in the case where substantial change to the aircraft structure or its engines are to be accomplished. It is our understanding that installation could, in fact, be accomplished by means of a "service bulletin". Why we are instructed by FAA to proceed in the most costly and cumbersome way is not understood nor does it serve to promote the enhancement of safety.

All the foregoing aside, it is the prevailing posture in industry to only proceed with improvements or alterations when there is a legal requirement to do so. Therefore, since the FAA is unwilling to proceed with a simple legal requirement that toxic fume protection be provided to all occupants on aircraft, not just some, then the net result is that there will be no protection. The FAA posture is clear from the cavalier manner with which the Administrator treated our petition for rulemaking. The FAA promished to address the toxic fume issues. Subsequently, as is apparent from the denial of the petition, the Adminstrator chose to completely ignore it.

The ultimate insolence to the traveling public and airline cabin personnel rests in the simple fact that there are presently no instructions of what to do and how to protect yourself during in flight fires nor is there any protective breathing equipment available. Moreover, the fire extinguishing equipment required, by regulation is quite frankly ridiculous from the standpoint of meaningful protection. The equivalent of a couple of buckets of water and two small hand-held chemical extinguishers in the cabin to save the lives of 450 people is an insult to any intelligent being.

In the face of these conspicuous and serious safety deficiencies, it would be charitable to say that I am dismayed when the Administrator has the audacity to state in his comments to the Senate inquiry last year: "In closing, I wish to reiterate that the FAA has thoroughly reviewed the issues raised by S. 1770, and I am satisfied that the current standards relating to the issues are adequate. We do not support the independent study called for by the bill and, in our view, the performance of such a study would call for the needless expenditure of funds at a time when fiscal prudence is clearly called for in every activity we undertake."

The Administrator is implying that the FAA is so strapped for cash that the agency can't even afford to tell the airlines to print safety instructions, let alone pay for the printing . . . How much of this downright juvenile insolence from the FAA are we supposed to put us with? . . . Their arrogance is mind boggling.

In the course of the hearings you asked me "Did they (FAA) ever tell you privately, off the record, what the reasons were?" in other words, the reasons for not implementing toxic fume protective breathing equipment. The Administrator's statement is clear and on the record. He is not interested in any improvements in safety equipment to protect the traveling public against toxic fumes. Moreover, even though there is a complete absence of any instructions whatsoever he says "That the FAA has thoroughly reviewed the issues . . ." and he is "satisfied that the current standards relating to the issues are adequate". He doesn't even want to study the matter! He considers it a ". . . needless expenditure of funds. . .". Outrageous as it sounds obviously those must be the reasons for not wanting to implement toxic fume protective breathing equipment nor safety instructions . . . If he worked for me I would fire him for premeditated neglect and incompetence.

Unquestionably, I am sure you will agree the administration of the FAA is casting serious aspersions on the many loyal and dedicated employees within the agency. This is regretable. Hopefully your efforts to get to the bottom of the problems will correct this in due course.

I trust the foregoing explanations and comments, along with the enclosures you requested, adequately detail the problems and our frustrations with FAA management.

I wish you well in your endeavors to accomplish direly needed improvements in these critical areas of aviation safety.

Sincerely,

BERTIL WERJEFELT, *President.*

Enclosures.

[May 20, 1980 Revised]

To: Langhorne Bond, Administrator, U.S. Federal Aviation Administration, Washington, DC.
From: Xenex Corporation, 1400 Kapiolani Blvd., Suite C-4, Honolulu, Hawaii 96814

PETITION FOR FEDERAL AVIATION ADMINISTRATION, U.S. DEPARTMENT OF TRANSPORTATION, RULE MAKING

SCOPE

Federal Aviation regulations, Parts 25, 121 and others as deemed applicable.

ISSUES

Crew and public health—airplane cabin air quality standards. Contamination limits, fresh air ventilation and humidification requirements.

SUMMARY

This petition for Rule Making proposes specific standards of air quality to be provided by operators of transport category airplanes for occupants on board. Basic air quality standards are proposed as a consideration for the issuance of type certificates for transport cateogry airplanes. Standards are proposed to apply to all operation of transport category airplanes by all carriers and commerical operators. The circumstances necessitating rule making and establishment of standards are several:

(1) Fresh air ventilation rates on board airplanes carrying passengers are oftentimes ⅕ to ⅒th the standards for fresh air ventilation required by law for minimum acceptable indoor air quality in a non-aviation environment.

(a) This poses and increased health hazard to crew and passengers.

(2) Passengers and crew complaints of physical discomfort while traveling, upper respiratory tract infection, eye irritation and symptoms of dehydration, during and after travel, attributed to the low humidity on board.

(3) Presently, in most cases, 95% of what humidity there is on board, is perspiration and expiration from occupants.

The establishment of standards and enforcement thereof will provide crew and the traveling public with an environment that, from a health, safety and comfort standpoint, approaches the basic minimum standards by law enforced in the non-aviation environment.

In the interest of public health and safety, it should be noted that between 200 million and 300 million passengers carried annually by the U.S. airlines are affected as well as more than 200,000 employees and crew members of the airline industry itself. This proposed rule making is intended not only to improve health, safety and comfort of occupants on board during transit, but may well serve to reduce after effects of air travel on passengers and crew, i.e. even though the air quality on board airplanes can be deemed grossly substandard and some passengers do not demonstrate adverse symptoms during flight, incubation periods for various viruses or bacteria may render these occupants ill at a later date. Thus, this rule making is of general public health interest even to the non-aviation community.

Existing rules, applicable to the manufacturer of aircraft. Air worthiness standards transport category airplanes type certificate Part 25.

Paragraph 25.831—Ventilation.

(a) Each passenger and crew compartment must be ventilated, and each crew compartment must have enough fresh air (but not less than 10 cu. ft. per minute per crewmember) to enable crewmembers to perform their duties without undue discomfort or fatigue.

(b) Crew and passenger compartment air must be free from harmful or hazardous concentrations of gases or vapors in meeting this requirement, the following apply:

One aviation medical examiner has informed Petitioner that he annually treats between 300 and 400 patients for acute eye trauma which can be directly attributed to the substandard environment on board aircraft.

(1) Carbon monoxide concentrations in excess of one part in 20,000 parts of air are considered hazardous for test purposes any acceptable carbon monoxide detection method may be used.

(2) Carbon dioxide in excess of three percent by volume (see level equivalent) is considered hazardous in the case of crewmembers. Higher concentrations of carbon dioxide may be allowed in crew compartments if appropriate protective breathing equipment is available.

(c) There must be provisions made to ensure that the conditions prescribed in paragraph (b) of this section are met after reasonably probable failures of malfunctioning of the ventilating, heating, pressurization, or other systems and equipment.

(d) If accumulation of hazardous quantities of smoke in the cockpit area is reasonably probable, smoke evacuation must be readily accomplished starting with full pressurization and without depressurizing beyond safe limits.

(e) Except as provided in paragraph (f) of this section, means must be provided to enable the occupants of the following compartments and areas to control the temperature and quantity of ventilating air supplied to their compartment or area independently of the temperature and quantity of air supplied to other compartments and areas:

(1) The flight crew compartment.

(2) Crewmember compartments and areas other than the flight crew compartment unless the crewmember compartment or area is ventilated by air interchange with other compartments or areas under all operating conditions.

(f) Means to enable the flight crew to control the temperature and quantity of ventilating air supplied to the flight crew compartment independently of the temperatiure and quantity of ventilating air supplied to other compartments are not required if all of the following conditions are met.

(1) The total volume of the flight crew and passenger compartments is 800 cubic feet or less.

(2) The air inlets and passages for air to flow between flight crew and passenger compartments are arranged to provide compartment temperatures within 5 degrees F. of each other and adequate ventilaiton to occupants in both compartments.

(3) The temperature and ventilation controls are accessible to the flight crew.

Existing rules, applicable to airlines operating passenger type aircraft. Transport category airplane—air carriers and commercial operators Part 121.

Paragraph 121.219—Ventilation.

Each passenger of crew compartment must be suitably ventilated. Carbon monoxide concentration may not be more than one part in 20,000 parts of air, and fuel fumes may not be present. In any case where partitions between compartments have louvres or other means allowing air to flow between compartments, there must be a means convenient to the crew for closing the flow of air through the partitions, when necessary.

COMMENTS ON EXISTING RULES

The existing rules as they address public and crew health and safety are, at best, perfunctory. Regardless of the contents of Par. 25.831, the aircraft operator is only required to conform to Par. 121.219.

In contrast to the negligible concerns for crew and passenger safety expressed in this just cited paragraph, the literature teaches us that in the non-aviation environment operators of hotels, restaurants, cocktail lounges, conference facilities, etc. are by law required to provide specific air quality for occupants of, or visitors to, such premises. In many cases, the responsible agency is the Department of Public Health rather than the Building Department through its codes.

Public health rules and regulations

In the non-aviation environment contamination limits and fresh air ventilation for minimum acceptable indoor air quality are well documented. Most commonly, rules and regulations pertaining hereto are established by state and federal departments of public health. Basis for these rules and regulations are, in many cases, derived from standards establshed by the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE). Enforcement is effected through various state and federal agencies, such as Building Departments, Department of Public Health, Department of Occupational Safety and Health and others. The various regulations and standards address specific criteria as well as generalized circumstances. In brief, as they apply to a comparable environment to passenger transport aircraft. We find the following.

1. Minimum Fresh Air Requirements.—For an estimated occupancy of 150 persons per 1,000 sq. ft. of floor area, fresh air ventilation requirements are minimum 35–40 cubic feet per minute per person (cfmp). In many cases, occupancy per 1,000 sq. ft. of floor area on an aircraft exceeds 150. 200 more closely approximates the circumstance on board aircraft. Unfortunately, the ASHRAE standards, for instance, do not anticipate such large densities. However, by straight line interpolation one will find that the appropriate fresh air ventilation rates shoud be at least 50 cfmp.

2. Maximum Contamination Standards.—Excepting obvious detrimental contaminants such as carbon dioxide, carbon monoxide, sulphur oxides, nitrogen oxides, ozone, and others, for which specific threshold limit values (t.l.v.) are established by the American Conference of Governmental Industrial Hygienists, other contaminants are dealt with on a subjective evaluation basis.

Standards for the control of bacteria, fungus, spores, virus, in general the containment of contageous disease, is only addressed in special applications, i.e., hospital operating rooms. It can be surmised, however, that the minimum ventilation rates previously described serve as basic tools for the removal or avoidance of accumulation of disease causing contaminants.

Due to the exceedingly high occupancy rate per square foot on board an aircraft, exceeding that anticipated by any public health regulations, this entire issue deserves consideration by appropriate professional bodies such as the American Medical Association, the Center for Disease Control and others.

3. Relative Humidity Limits.—Some public health regulations and ventilation standards address the issue of relative humidity (RH) in ambient air. Unfortunately, there has been little need to consider this issue other than in a subjective manner relating to comfort. Humidity is so much a part and necessity of our daily lives that it is virtually taken for granted that minimum levels, from a health standpoint, are always attained. The basic problem confronting air conditioning engineers most commonly relate to the removal of excess humidity. The recommended levels of RH are between 30 and 60% depending on the room temperature.

COMMENTS

Contamination limits, fresh air ventilation and humidification requirements relating to the nonaviation environment are well documented. Detailed information is readily available through most departments of public health and building departments as well as the numerous professional organizations engaged in these fields. The most widely adopted standards are those of the ASHRAE.

BRIEF BACKGROUND, AIRPLANE CABIN AIR QUALITY STANDARDS

Contrary to popular belief, the air quality on board aircraft usually is only a fraction of the minimum health standards found in comparable environments on the ground.

The problem is one of insufficient fresh air ventilation compounded by insufficient humidity; moreover, what humidity there is aboard a plane is 95% unsterilized perspiration and expiration from fellow occupants. Body odors of external as well as internal origin further impair the air quality.

The airline industry for three decades has recognized that fresh air should be supplied into a plane's cabin at a rate of 30 to 50 cfmp. This is the implied recommended minimum level by the ASHRAE for a comparable environment on the ground.

Because of technical complexities associated with providing this amount of fresh air—namely an unbearable low relative humidity on board—the industry for the past thirty years has provided only 15-20 cfmp of fresh air. By reducing the input of fresh air to these levels, the relative humidity on board rises from as low as 4% to as high as 12%, the latter still being less than in most desert areas of the world.

With the recent advent of the fule crisis, however, airlines have reduced the input of fresh air still further to between 5 and 7 cfmp for "fuel conservation measures". By doing so, the relative humidity rises to a high of approximately 20% (almost all perspiration and expiration). In order that passengers have a feeling of reasonable ventilation, approximately 70% of the used air is "recirculated". In some cases, this recirculated air is filtered for small particles. The cockpit crew is, by a separate ventilation system, provided essentially 100% fresh air.

In order for the airlines to provide adequate humidity, at minimum ventilation rates of 30-50 cfmp it would be necessary to carry on board, for a 5-8 hour flight, several thousand pounds of water. Additionally, they would have to carry extra fuel for the carriage of this water and, at the expense of freight revenue, provide space for the water. In the ultimate, these circumstances impose an economic burden to the consumer who, in turn, will have to pay a higher price for air travel.

Presently, the reduced ventilation rates commonly found on board an aircraft provide a savings to airline operators. Based on average aircraft utilization and load factors, this amounts to approximately 50¢ per transcontinental passage.

Recent developments in the field of aviation environmental control systems indicate that it may be possible to provide "full" ventilation and 30-50% RH within economically acceptable boundaries. This, in contrast to the state of the art over the last three decades where adequate ventilation and humidification carried a high price tag to the consumer and industry.

In light of the health standards that people from developed nations now take for granted in the nonaviation environment, we see no reason that like standards should not be applied in aviation, especially so since the fresh air ventilation rate in many instances, is 1/10th of what is otherwise termed the minimum health standard. Additionally, low ventilation rates cause accumulation of undesirable contaminants and odors on board. This, in part, owing to the fact that humidification is accomplished almost in total from the perspiration and expiration of occupants on board. Parenthetically, in many cases, pressurization and ventilation on current aircraft results almost exclusively from uncontrolled aircraft leakage.

PROPOSED RULES

Petitioner recognizes that relevant industrial organizations involved in aviation, as well as employee unions of these industries, along with state and federal agencies and professional associations, will contribute to the final formulation of acceptable regulations pertaining to fresh air ventilation, humidity and contamination limits. The rules proposed herein are of a basic and preliminary nature taking the aforementioned fact into account. In all likelihood, due to the unique and very congested nature of the aircraft environment, the ultimate regulations may have to be more stringent in order to properly address basic health, safety and comfort standards for crew and public.

It is proposed that Par. 121.219—Ventilation, be deleted and replaced as follows: Par. 121.219 Cabin Air Quality Standards. All passenger and crew compartments shall be ventilated with fresh air at the mimimum rate of 35 cfmp, where occupancy density is below 120 persons per 1,000 sq. ft. of floor area; at a minimum rate of 50 cfmp for occupancy density between 120-180 persons per 1,000 sq. ft. of floor area; and at a minimum rate of 65 cfmp for occupancy density of over 180 persons per 1,000 sq. ft. of floor area.

Uncontrolled aircraft leakage shall be maintained at less than 20%. Contaminants shall be maintained at 1/10th of the t.l.v. as established by the American Conference of Governmental Industrial Hygienists. Relative Humidity at all times shall be maintained between 30 and 50%. Water used to provide said humidity shall be free of organic and chemical compounds in accordance with acceptable public health standards for potable water as defined by the American Conference of Governmental Industrial Hygienists. The vapor in the air on board shall, at no time, be composed of more than 20% unsterilized perspiration and expiration originating from occupants on board. The air on board shall be free of offensive orders.

Concern for the health of passengers and crew mandates that suitable monitoring of air contamination by various pathogens (bacteriological, viral and fungal) causing diseases by instituted. Further, in this regard, the allowable quantity of properly filtered recirculated air shall never exceed 7 cfmp.

All values herein described, where applicable, shall be adjusted to sea level equivalent.

Failure to comply with the minimum requirements stated shall be deemed sufficient justification for the administrator to deny a certificate holder further use of said aircraft for the purpose of passenger transport until such time that compliance is demonstrated. Repeated failures to comply, where the operator cannot demonstrate justifiable cause, shall be grounds for the administrator, after appropriate notice and hearing, to impose fines up to a maximum of $———, in addition to denying the certificate holder the right to transport passengers.

Operators and certificate holder of said aircraft, at the request of the administrator, shall permit the F.A.A. to monitor, with its equipment, passenger carrying aircraft, to ascertain whether there is compliance with the standards set forth.

Notwithstanding the foregoing provision, the administrator may require that the operator demonstrate by supportive engineering data that operator is capable of compliance.

It is further proposed that FAR 25.831—Ventilation be appropriately amended to conform to the standards reflected in the new proposed FAR 121.219—Cabin Air Quality Standards.

COMMENTS TO PROPOSED RULE 121.219

It is believed that the strict enforcement of this rule will substantially reduce passenger and crew upper respiratory tract ailments, eye irritation and ailments and dehydration symptoms and in general, provide a much needed improved environment for occupants on board aircraft. The spread of contageous disease will be substantially reduced. Further, enforcement of these rules will bring the aviation industry to health standard parity with other industries dealing with the public.

It may at first appear that the economic burdens imposed on the industry by these rules would be excessive, however, recent advances and continued development and improvement of environmental control systems negates this argument. Previously, aside from capital expenditures for equipment installations, the cost to the U.S. industry for complying with these regulations would have been on the order of several hundred million dollars annually. Recently proposed ECSs appear to reduce these expenditures to less than 1/20th. As in other similar cases, the economic burden relating to this rule will be borne by the consumer. In today's market the cost to the consumer translates to approximately 20¢ per transcontinental ticket—approximately 1/10th to 1/20th the cost of an average meal on board.

Is it reasonable to make the foregoing demand on the aviation industry? Yes, considering that all other industries similarly situated are forced by law, for public health reasons, to comply with these basic public health requirements. The human requirements for fresh and uncontaminated air are undiminished whether or not there is a fuel crisis or other factors affecting the cost of providing such service.

Reference materials and bibliography are, in part, apparent from the Petition. Additional information and references to further substantiate credibility and veracity of this Petition are available upon request from Xenex Corporation, 1400 Kapiolani Blvd., C-4, Honolulu, Hawaii 96814.

XENEX CORP.,
Honolulu, HI, November 19, 1981.

Re: Your phone call 18 November 1981 Concerning Installation of Toxic Fume Protective Breathing Equipment for Passengers and Crew Members—Clarificaton of FAA Policy and Approval Methods.

Mr. KEITH ANDERSON,
Chief, Los Angeles Area, Aircraft Certification Office, Federal Aviation Administration ANM-100L, Donald Douglas Drive, Long Beach, CA.

DEAR MR. ANDERSON: Thank you for your phone call concerning the above referenced matter. I have enclosed herewith copies of petinent materials and communications evidencing the Catch-22 situation we are subjected to by the FAA in our efforts to improve a grossly neglected area in aviation safety—toxic fume protection for passengers and crew. Following is a summary of the sequence of events leading to the FAA's refusal to permit installation of direly needed safety equipment on board aircraft.

1. In a meeting with Mr. Charles R. Foster, Director Northwest Region FAA, in February of 1981, he confirmed that some of the automatic Xenex systems required conventional STC approval. However, it was clearly stated that our Series 200 (not designated so at the time) which is a system that connects to the fresh air outlets, could be installed on board aircraft without FAA approval. This was confirmed in a letter dated 4 March 1981 to Mr. Foster (Exhibit "A" attached).

2. Xenex Corp. subsequently proceeded with prototype work, final design and arrangement for the manufacture of the 200 Series.

3. Xenex Corp. in the course of several meetings and by letter dated 4 September 1981 to Mr. Hugh E. Waterman, Chief, Systems and Equipment Branch FAA ANW-130L, requested approval for some of our automatic systems, installation of which concern TSO and STC requirements for approval (Exhibit "B" attached).

4. In a letter from the FAA by Mr. Waterman, dated 14 September 1981, to Xenex detail procedure for approval of our automatic systems by means of an STC were disclosed to us (Exhibit "C" attached). The letter improperly inferred that the Xenex Series 200 system was also to be approved by the STC method.

5. In a letter from Xenex Corp. to Mr. Waterman, dated 21 October 1918 (Exhibit "D" attached), Xenex asked for confirmation that the Xenex Portable Emergency Life Support System (Xenex PELS) Series 200 is excluded from the STC procedure.

6. In a letter from the FAA by Mr. Waterman to Xenex Corp. dated 2 November 1981 (Exhibit "E" attached), we are informed that contrary to Exhibit "A", the Xenex PELS Series 200 may be approved by a field inspector under a simple form 337 procedure. It is, however, pointed out that this form is normally for one aircraft only.

7. Xenex Corp., based on the information in Exhibit "E", had several discussions during the week of 9 November 1981 in Honolulu with FAA's Gary K. Nakagawa, Chief, Airworthiness District Office APC 210 (Exhibit "F" attached). Mr. Nakagawa refused approval under the form 337 procedure for the Xenex PELS Series 200 system. Mr. Nakagawa contends, among other things, that installation of new types of emergency equipment, not required by law, on board aircraft is a policy decision to be decided by higher authorities in the FAA, not an inspector in the field. (Letter 19 Nov. 1981.)

The foregoing sequence of events is a classic case of Catch-22 wherein the actions of the FAA are a detriment to improved aviation safety. It would appear from our above outlined experience that it may not be possible for an airline to obtain FAA approval to improve safety in order to protect its passengers and crew from smoke and toxic fumes. If, in fact, as stated by Mr. Nakagawa that no action can be taken until "higher authorities in the FAA" arrive at some policy decision then it would appear that our efforts to date to obtain STC and TSO approval have been futile and the substantial sums of money and time that our company has invested in the development of those products may have been for naught as a result of misleading actions on the part of the FAA.

Who should we believe in this matter—Mr. Foster, who says no approval is necessary? Mr. Waterman who states that a simple form 337 procedure is all that's necessary? Or Mr. Nakagawa who states that neither of the above is corect, rather FAA in Washington must come to some further policy decision before any approvals can be granted?

Our patience is at an extremely low ebb for what we believe are good reasons. It has been almost a year since Xenex asked the FAA to take action on the serious fire and smoke hazards confronting passengers on aircraft. The problem has been known to the FAA for decades and no action has heretofore been taken. You may be aware that Xenex in 1980 filed a petition to improve health and safety problems on board aircraft. This petition was denied.

In a letter to Mr. Langhorne Bond, then Administrator of the FAA, dated 22 December 1980 (Exhibit "G" attached), we requested information pertaining to our petition (FAA Docket 20351) concerning protection against smoke or fire on board aircraft. In response to our letter of 22 December 1980, Xenex received a letter from the FAA dated 12 January 1981 assuring us that the serious smoke and fire issues "would be included in the FAA consideration of your petition" (Exhibit "H" attached). The letter was from Mr. Jerry Chavkin, Chief, Aircraft Engineering Division, Office of Airworthiness, Washington, D.C. Subsequent to these communications and several other communications by ourselves and other parties with the FAA, Mr. Charles E. Weithoner, Acting Administrator of the FAA, on 3 March 1981 denied the petition for rulemaking without so much as mentioning the smoke and fire issues under the scope of our petition (Exhibit "I" attached). This action was in direct contradiction to that which we had theretofore repeatedly been told verbally and in writing.

In the face of more than 600 fatalities due to asphyxiation on American made aircraft in less than 2 years, the public and the airline industry is looking to the FAA for guidance and direction. So are we. It is obvious from the foregoing that such guidance and direction has not been provided to date by the FAA nor is there any indication of when it will be forthcoming. One would hope that it will not take a tragic disaster at National Airport in Washington for the FAA to open its eyes.

As explained to you, the Catch 22 situation is very costly to our company. We have viable solutions to problems that industry has recognized for more than 20 years. It is not expensive and there is no reason why it should not be implemented industrywide. We have been repeatedly frustrated in our efforts to improve aviation safety.

We have been verbally informed by the FAA that it is considering issuing an Advisory Circular and a subsequent Airworthiness Directive in order to improve aviation safety as it concerns smoke and fire on board aircraft. Based on our experience to date, it is difficult to believe that such action would be taken within the near future.

We have made every effort to work within the FAA guidelines to obtain approval for our 200 Series, only to find that perhaps no such "guidelines" exist. We were willing to take the extra step and go thru a form 337 approval procedure despite the fact that Mr. Foster told us that no approval was necessary. Now that we are ready to proceed with installations we are informed by a local filed office that even the form 337 procedure is unacceptable to the FAA. As we stated earlier we have serious question of where direction is coming from within the FAA, if in fact any direction, or policy, for that matter exists.

We would hope you will understand our frustration in these and related matters and will be able to quickly provide concise answers so that we may proceed with our sales and installations of these products which will greatly improve airline safety in this long neglected area. We have patiently awaited FAA action before taking our product directly to the public for sale to individual passengers and crewmembers. Obviously, if passengers begin carrying on board their own safety equipment this would cause serious embarrassment to the FAA, aircraft manufacturers, and the airline industry in general for their lack of appropriate exercise of fundamental responsibility and, seriously erode the public trust and confidence in air travel safety which government and industry have worked so hard to establish. It is not our desire to take the direct sales approach, but the FAA's actions, or lack thereof may leave us no alternative.

I look forward to meeting with you on the 24th at which time we can discuss this untenable situation in further detail. I hope, by that time, your personal involvement in these matters will provide positive results.

Sincerely,

BERTIL WERJEFELT, *President.*

Enclosures: Exhibits "A" thru "I".

XENEX CORP.,
Honolulu, HI, March 4, 1981.

Mr. CHARLES R. FOSTER,
Director, Northwest Region, FAA—Boeing Field, King County International Airport, Seattle, WA.

DEAR MR. FOSTER: I much enjoyed our meeting week before last concerning the Xenex Portable Emergency Life Support System (PELS System). Your comments, advice and encouragement were carefully noted and sincerely appreciated.

As I understand from our discussion, the use of the Xenex PELS System on board aircraft, can to a substantial degree, be effected by the airlines themselves without FAA approval, so long as there are no modifications made to the existing aircraft structure or systems per se. Since our systems comprise a fresh air supply source in conjunction with a face mask and/or air storage bladder systems, it is apparent that a large number of aircraft can readily use the Xenex PELS System with essentially no modification whatsoever to the aircraft or its systems. Other aircraft, which are not equipped to provide passengers with an individual fresh air source, would require modifications and consequent approval of such modification by the FAA, in order to facilitate the use of the Xenex PELS System. Such modification and request for FAA approval and supplementary type certification would be initiated by the respective airlines.

It is a fact that there are virtually no instructions whatsoever on board passenger carrying aircraft advising the traveling public of what to do in case of smoke or fire emergencies in flight. A further fact is that a large number of fatalities, relating to smoke or fire on board aircraft, are attributed to asphyxiation rather than burning. The need for safety improvements is painfully obvious. We welcome the support of the FAA in implementing the Xenex system in an effort to substantially improve safety.

If my understanding of our discussion, reflected above, is not correct, I would appreciate your further comment.

Very truly yours,

BERTIL WERJEFELT, *President.*

XENEX CORP.,
Honolula, HI, September 4, 1981.

Re: Request for Letter of Approval; Xenex Corp. statement of Conformance of Xenex Portable Emergency Life Support (PELS) Systems and Xenex Stationary Emergency Life Support (SELS) Systems to TSO-C64.

Mr. HUGH E. WATERMAN,
Chief, Systems and Equipment Branch, FAA ANW-130L, Donald Douglas Drive, Long Beach, CA.

DEAR MR. WATERMAN: Subject to our previous meeting and phone conversation, we are hereby requesting formal approval of modifications to oxygen mask assembly, continuous flow, passenger, for use in air carrier aircraft, TSO-C64.

As previously explained, and as is apparent from enclosed drawings Ref. Nos./ Origin 780900, 1 thru 6 of 15, describing Xenex Emergency Life Support Systems Series 100 thru 400 (series 200 does not fall within the TSO requirements), the modifications are additions to the existing TSO-C64 equipment. Tests and investigations reveal that the modifications do not alter or impede the performance of the passenger oxygen mask assembly, under the regulatory requirements, to supply the user with certain quantities of oxygen and ambient air.

The purpose for the modifications is to provide protection for passengers against smoke, toxic fume and asphyxiation haxards, with the same equipment required under the FARs for supplementary oxygen, utilizing the additional components described in the drawings.

All modification components are and will be made of materials that conform to the regulatory requirements for flammability, toxic fume emissions from combustion, etc.

Hoses and value openings utilized in connection with the ambient air intake value (B) of the mask assembly are all of appropriate dimensions so as not to impede the air used for dilution in the mask. In addition, I call your attention to the optional value assembly (F) which permits the user discretion to use either static ambient air or ducted pressurized air (.3" to .5" of water commonly) as the dilution gas source when utilizing the entire assembly for the purposes set forth under TSO-C64. It is recommended that when the optional value (F) is used, the entire assembly be presented to the user with the value opened to the static ambient port. If the need for smoke protection arises, this static ambient port is closed allowing only ducted, pressurized air through the hose and into the mask. Further, when using the PELS System for a prolonged period (more than 8 minutes) for smoke protection, where there is minimal duct pressure, an overflow value (J) is provided in order to vent excess CO^2 from the rebreathing bag. The CO^2 would otherwise escape from the mask due to normal positive pressure.

Although valve and disconnect assemblies on the drawings are positioned below the bag, they can obviously be positioned anywhere up to and including the mask.

Xenex Corporation certifies, that based on our tests and investigations, modified articles, Xenex SELS Series 100 and Xenex PELS Series 300 and 400 meet all requirements of TSO-C64. We respectfully, therefore, ask for your letter of approval.

Sincerely,

BERTIL WERJEFELT, *President.*

Enclosures.

DEPARTMENT OF TRANSPORTATION,
FEDERAL AVIATION ADMINISTRATION,
Long Beach, CA, September 14, 1981.

In reply refer to: ANW-130L:FL.
XENEX CORP.,
1400 Kapiolani Boulevard, Suite C-4,
Honolulu, HI.

(Attention of Mr. B. Werjefelt).

XENEX PORTABLE AND STATIONARY EMERGENCY LIFE SUPPORT SYSTEMS

GENTLEMEN: This is in reply to your letter dated September 4, 1981 which transmitted preliminary drawings for the Xenex portable and stationary emergency life support systems.

We have conducted a cursory review of the preliminary drawings and not on any test data and find that the general principles of the support systems appear acceptable. However; it should be noted that final approval of the support systems is contingent on the issuance of a Supplemental Type Certificate (STC) for the installation of these systems in an aircraft. The normal procedure for obtaining an STC would include the following:

(a) Submittal of an Application for STC, FAA Form 8110-12 (copies attached).

(b) Submittal of all detailed drawings including process and procurement specifications for the support systems and for the modifications made to the aircraft.

(c) Submittal of installation instructions.

(d) Submittal of substantiating data which shows the modification and installation of the systems complies with the applicable Federal Aviation Regulations (FAR). This would consist of test reports, computation and analysis.

(e) The necessary functional, proof and operational tests for the systems must be conducted, it is suggested that a test proposal be submitted before conducting the tests. It should be noted that all official tests will be witnessed by an FAA engineer unless prior authorization is obtained to the contrary.

(f) FAA conformity inspection of the systems and installation must be conducted.

If you have any other questions, please contact this office, telephone number (213) 548-2831 or our FAA office in Honolulu, Hawaii, telephone number (808) 546.0340.

Sincerely,

FREDERICK LEE,
For Hugh E. Waterman, Chief, Systems and Equipment Branch.

Enclosures.

Xenex Corp.,
Honolulu, HI, October 21, 1981.

Mr. **Hugh E. Waterman,**
Chief, systems and Equipment Branch, Department of Transportation, Federal Aviation Administration, Donald Douglas Drive, Long Beach, CA.

Dear Mr. Waterman: Your letter of September 14, 1981 does not make clear the fact that the Series 200 Xenex Portable Emergency Life Support System is not subject to STC approval. The Series 200, as you know, is stored in a seat back, underneath a seat, or other appropriate place. This system is user activated by means of connecting the end of the hose to the fresh air outlet.

We would appreciate your confirmation of this matter at your early convenience.

Very truly yours,

Bertil Werjefelt, *President.*

Department of Transportation,
Federal Aviation Administration,
Long Beach, CA, November 2, 1981.

In reply refer to: ANM-131L.
Xenex Corporation,
1400 Kapiolani Boulevard, Suite C-4,
Honolulu, HI.

(Attention of Bertil Werjefelt)

Gentlemen: This is in reply to your letter dated October 21, 1981, concerning your Xenex Portable Emergency Life Support System Series 200.

The installation of this system may be approved by the FAA Form 337 method at the discretion of the inspector in lieu of a Supplemental Type Certificate (STC). However, it should be noted that the FAA Form 337 approval is normally for one airplane only.

Sincerely,

Frederick Lee,
(For H. E. Waterman, Chief, Systems and Equipment Branch).

Xenex Corp.,
Honolulu, HI, November 19, 1981.

Re: Form 337 Procedure for Approval of Xenex Portable Emergency Life Support System Series 200.

Mr. **Gary K. Nakagawa,**
Chief Airworthiness District Office, Federal Aviation Administration APC 210, 300 Ala Moana Boulevard, Honolulu, HI.

Dear Mr. Nakagawa: I wish to confirm our several discussions during the week of November 9 concerning the above referenced matter.

You informed us that you would not approve our Xenex PELS Series 200 for installation on board aircraft under the form 337 procedure. Among your reasons for refusing approval you contend that the installation of emergency equipment, not required by law, on board aircraft, is a policy decision matter of higher authorities within the FAA. I will, therefore, pursue this matter with higher authorities within the FAA.

Very truly yours,

Bertil Werjefelt, *President.*

Xenex Corp.,
Honolulu, HI, December 22, 1980.

Re: Your 11 December 1980 letter to Congressman Cecil Heftel concerning Docket 20351, PR80-10.

Mr. **Langhorne Bond,**
Administrator, Federal Aviation Administration,
Washington, DC.

Dear Mr. Bond: We have received, from the FAA, a copy of the above referenced letter. We are pleased to learn that an FAA decision on Docket 20351 will be forthcoming shortly. In the meantime, however, your letter to Congressman Heftel leads us to believe that the FAA is viewing the air quality standards issue, brought forth in our petition, primarily from the normal operations, medical standpoint. Air quality standards obviously also encompass abnormal operations, such as when there is smoke or fire on board.

We have taken for granted that the FAA's considerations relating to our petition for rulemaking encompass normal as well as abnormal operations. We would appreciate if you would advise us at your early convenience if the abnormal operations are also a part of your considerations and in this regard, what significance you attribute to them, relative to normal operations.

Sincerely,

BERTIL WERJEFELT,
President.

DEPARTMENT OF TRANSPORTATION,
FEDERAL AVIATION ADMINISTRATION,
Washington, DC, January 12, 1981.

Mr. BERTIL, WERJEFELT,
President, Xenex Corporation,
1400 Kapiolani Boulevard, Suite C-4, Honolulu, HI.

DEAR MR. WERJEFELT: You letter of December 22, 1980, to Mr. Langhorne Bond concerning your petition for rulemaking (Docket Number 20351) pertaining to air quality standards was referred to my office for answering.

You asked if Federal Aviation Administration (FAA) consideration of your petition would include normal operating conditions as well as abnormal operating conditions, such as smoke and fire. Since your petition for rulemaking did address the ventilation rules, which include FAR 25.831(d), those requirements would be included in the FAA consideration of your petition. Should you wish to address more than FAR 25.831(d) your petition would require amendent, republishing in Federal Register for comment and after the comment period, evaluation of the public comments. This would result in considerable delay in the current processing of your petition.

Unless advised otherwise, the FAA will continue processing the current petition.

Sincerely,

JERRY CHAVKIN,
Chief, Aircraft Engineering Division, Office of Airworthiness.

United States of America, Department of Transportation, Federal Aviation Administration, Washington, DC 20591

(Regulatory Docket No. 20351)

IN THE MATTER OF THE PETITION OF XENEX CORPORATION, TO AMEND SECTIONS 25.831 AND 121.219 OF THE FEDERAL AVIATION REGULATIONS

DENIAL OF PETITION

By letters dated May 8 and May 23, 1980, Bertil Werjefelt, President, Xenex Corporation, 1400 Kapiolani Blvd., Suite C-4, Honolulu, Hawaii 96814, petitioned the Federal Aviation Administration (FAA) to amend §§ 25.831 and 121.219 of the Federal Aviation Regulations (FAR) to improve airplane passenger and crew compartment air quality standards.

Section 25.831 states, in pertinent part, that each passenger and crew compartment must be ventilated and that each crewmember must have at least 10 cubic feet of fresh air per minute. Also, passenger and crew compatment air must be free of harmful or hazardous concentrations of gases or vapors. Maximum permissible concentrations of carbon monoxide and carbon dioxide are specified.

Section 121.219 states, in pertinent part, that passenger and crew compartments must be suitably ventilated and fuel fumes may not be present and also specifies a maximum carbon monoxide concentration of one part in 20,000 parts of air.

In support of its petition, Xenex Corporation (Xenex) presents a number of arguments which are discussed in the following paragraphs.

The petitioner contends that crew and passengers are subject to health hazards while flying as a result of inadequate ventilation. In addition, fresh air ventilation rates on board airplanes carrying passengers are only 10 to 20 percent of the "fresh air ventilation" required by law for minimum acceptable indoor air quality in a nonaviation environment. The petitioner does not substantiate the health hazards to which it believs the crew and passengers are being subjected, nor does it provide information regarding the extent of the health problems being encountered. The petitioner does not explain how it arrived at the conclusion that passenger-carrying airplane ventilation is only 10 to 20 percent of that required by law for nonaviation environments. The petitioner also fails to identify the law to which the reference is made.

Xenex claims that the ventilation recommended by the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) for indoor nonaviation environments should apply to passenger transport aircraft. The petitioner fails to explain why another ASHRAE standard which contains recommended ventilation [1] standards for passenger transport aircraft should not be used. ASHRAE 1978 Applications Handbook, Chapter 9—Aircraft, states in part, "A portion of the cabin air may be recirculated, but it should be filtered and purified if it is a large percentage of total ventilation or unless it is recirculated for limited times only. The recommended ventilation rate is 2.4 liters per second (l/s) per passenger and 14.2 l/s for cockpit crew members." The recommended ventilation rate of 2.4 l/s equates to approximately 5 cubic feet per minute (cfm). and 14.2 l/s is approximately 30 cfm. The current rule requires for each crewmember a minimum of 10 cfm of fresh air plus additional ventilation to perform his or her duties without undue discomfort or fatigue. A review of the ventilating characteristics of the crew cabin in seven current transport airplanes reveals that the minimum ventilation rates vary from 70 to 150 cfm per crewmember with air changes ranging from 20 to 87.8 per hour which exceeds the ASHRAE recommendation.

Xenex proposes fresh air ventilation at 35 to 65 cfm/person. The petitioner does not provide justification for such large quantities of fresh air flow. For buses and trains, the ASHRAE indicates that 20 to 25 percent outdoor air is adequate. Even using the minimum recommended ventilation for cocktail lounges (30 cfm/person) as an appropriate standard for transport aircraft, it would require only 6 to 7½ cfm/person of fresh air rather than 35 to 65 cfm/person as proposed. The petitioner proposes that filtered recirculated air shall never exceed 7 cfm/person. No support for this proposal is included in the petition.

A review of the ventilating characteristics of seven current transport airplanes reveals that the ventilation varies from 15.2 to 25.7 cfm/person in the passenger cabin or 3 to 5 times that recommended by ASHRAE. When cabin air is recirculated in these airplanes, appropriate air conditioning is accomplished.

The petitioner proposes that uncontrolled aircraft leakage be less than 20 percent. The proposal is not clear because the petitioner does not indicate what criteria requires that the leakage must be less than 20 percent.

Xenex proposes that contaminants be limited to 0.1 of the threshold limit values as established by the American Conference of Governmental Industrial Hygienists. Xenex proposes that cabin air be monitored for contamination caused by pathogens. Pathogens are any micro-organisms or viruses that can cause disease. No justification for this proposal is presented, nor is the action identified which is to be taken by an air carrier if such monitoring is instituted.

The petitioner proposes that the air on board shall be free of offensive odors. The issue of offensive odors involves subjective evaluation and is not an issue for which safety rulemaking is appropriate.

Xenex proposes that, at all times, the relative humidity in aircraft cabins be maintained between 30 and 50 percent. It is also proposed that water used to humidify the cabin be free of organic and chemical compounds in accordance with acceptable public health standards for potable water as defined by the American Conference of Governmental Industries Hygienists. Xenex further proposes that the vapor in the air on board transport aircraft shall be composed of no more than 20 percent unsterilized perspiration and expiration originating from occupants on board.

Xenex fails to show that there is a physiological need for such high levels of humidification during flight. Although human comfort may be affected by humidity, no evidence is presented by the petitioner to allow the conclusion that humidity, or lack of it, causes health problems in normally healthy people. Regarding the purity of water used in humidification, the petitioner has not shown that the quality of water used in humidifying systems has ever affected passenger or crew safety. The petitioner's proposal that water vapor not be more than 20 percent unsterilized perspiration and expiration is not supported. No evidence was found that such a requirement exists or is needed today for persons in any environment.

---

[1] Ventilation. The process of supplying or receiving air by natural or mechanical means, to or from any space. Such air may or may not have been conditioned. American Society of Heating, Refrigerating, and Air Conditioning Engineers—Handbook of Fundamentals, Terminology.

The Federal Aviation Administration published the Xenex Corporation petition for rulemaking, verbatim, for public comment, in the Federal Register (45 FR 41962) on June 23, 1980. All communications received on or before August 22, 1980, were considered by the Administrator before this action was taken. The FAA received comments from 29 individuals, organizations, and companies in response to the petition. The majority of these supported either the petition or the intent of the petition without taking a position on the particular levels for humidity, contaminants, or fresh air circulation rates. Two commenters cite illnesses, flu, and chicken pox, contracted after an airline flight, which they attributed to poor air quality on the airplanes. Several comments were made that the fresh air ventilation standards for aircraft are not equal to those of other public or non-aviation environments. None of these comments were substantiated by information or data.

There were comments from five organizations and companies opposed to the petition. The Aerospace Industries Association, (AIA) contends that implementing the proposal would cost the airlines $633 million per year for the Boeing 727 aircraft fleet and $1.319 billion per year for the Boeing 747 aircraft fleet. This contention was supported by a detailed cost analysis. In addition, data were submitted which show that the ventilation rates and number of outdoor air changes per hour for seven different air carrier aircraft exceeds the most stringent recommendations for public gathering places, specifically night clubs.

The petitioner submitted a general rebuttal to the cost estimate from the AIA. However, while recognizing that the proposals would be costly, the petitioner did not offer any counter cost estimates nor did it present data to show that any retrofit of additional equipment is justified in the interest of aviation safety. In this connection, it may be noted that FAA regulations do not preclude installation of additional air conditioning, filtering, and humidifying equipment that meets airworthiness standards should an airline elect to do so in the interest of increasing passenger comfort.

In consideration of the foregoing, I find that the petition does not justify instituting the rulemaking procedures requested by the petitioner. Therefore, in accordance with rulemaking procedures of Part 11 of the Federal Aviation Regulations, the petition of the Xenex Corporation to amend §§25.831 and 121.219 of the Federal Aviation Regulations is hereby denied.

Issued in Washington, D.C., on March 3, 1981.

CHARLES E. WEITHONER, *Acting Administrator.*

XENEX CORP.,
Honolulu, HI, December 18, 1981.

Hon. J. LYNN HELMS,
Administrator, Federal Aviation Administration,
Washington, DC.

DEAR MR. HELMS: We are writing this letter to you to seek your personal intervention, assistance and response pertaining to the matters disclosed in the enclosed materials. The enclosures call attention to serious health and safety deficiencies concerning not only protection against smoke and toxic fumes for passengers and crew, but also fresh air ventilation and pressurization practices in the commercial transport sector of the aviation industry.

As is evident from Exhibit 10 there apparently is a gross absence of policy and/or direction within the FAA concerning the serious safety issues of smoke and toxic fume protection. Although our company previously has been given approvals from the FAA to install the Xenex Emergency Life Support Systems on board U.S. transport aircraft, this position was recently reversed. A denial by the FAA to permit installation of this direly needed and long sought after safety equipment is apparently based on the premise that installation of emergency and safety equipment on board aircraft (for use by the public) not required by law, is a policy decision matter within the FAA.

We understand the Lead Region Staff in Seattle is looking into the matter, however, we have been given no indication of when they will reach a decision.

For at least two decades, considerable sums of money have been expended by FAA and private industry on research to eliminate the problem. Viable solutions presently exist, however, cannot be implemented until the FAA takes action. We believe the problem is of national importance and will require your offices' direct involvement to achieve an appropriate and timely decision on these matters.

The FAA, which is empowered to promote aviation safety, is currently on record as refusing to permit installation of the Xenex Portable Emergency Life Support (PELS) Systems as smoke and toxic fume protective breathing equipment for passengers and crew. We are asking your personal involvement and response in correcting this situation. We look forward to your early reply.

Sincerely,

BERTIL WERJEFELT, *President.*

XENEX CORP.,
Honolulu, HI, January 27, 1982.

Hon. J. LYNN HELMS,
Administrator, Federal Aviation Administration,
Washington, DC.

DEAR MR. HELMS: We have not received your response to our letter to you of 18 December 1981 (copy enclosed). When can we expect same?

Sincerely,

BERTIL WERJEFELT, *President.*

Enclosure.

DEPARTMENT OF TRANSPORTATION,
FEDERAL AVIATION ADMINISTRATION,
Washington, DC, January 29, 1982.

Mr. BERTIL WERJEFELT,
President, Xenex Corporation, 1400 Kapiolani Boulevard, Suite C-4, Honolulu, HI.

DEAR MR. WERJEFELT: This is in reply to your December 18, 1981, letter in which you seek my personal intervention, assistance, and response to matters disclosed in the enclosures to your letter. Regulatory Docket No. 20351, which denied your petition, contains voluminous comments and analysis and for the most part provides an adequate response to the first paragraph of your letter.

The supplemental type certificate (STC) procedures outlined in the September 14, 1981, letter from Mr. Hugh Waterman of our Long Beach office, Northwest Mountain Region, provide the necessary information you need to make an STC application for those Portable Emergency Life Support (PELS) systems which require modification to the aircraft. I have asked the Northwest Mountain Region Certification Directorate to review your PELS Series 200 system, which does not require modification to the aircraft. This region is the Certification Directorate responsible for your geographical area. It will assess the necessity of the Federal Aviation Administration's approval, the system's compatibility with the aircraft ventilation system, and its effect on passengers in the cabin. I have also asked for an expeditious direct reply to you on this matter.

Sincerely,

J. LYNN HELMS, *Administrator.*

DEPARTMENT OF TRANSPORTATION,
FEDERAL AVIATION ADMINISTRATION,
Long Beach, CA, February 22, 1982.

In reply refer to: ANM-130L.
ZENEX CORPORATION,
1400 Kapiolani Boulevard, Suite C-4,
Honolulu, HA.

(Attention of Bertil Werjefelt)

GENTLEMEN: We are now able to advise you regarding the extent of FAA involvement with Xenex protective breathing equipment and this letter is the response promised in our letter to you of November 30, 1981, and in Administrator Helms' letter to you of January 29, 1982.

The Xenex Model 200, which we understand may be carried on-board individually and requires no permanent change to the aircraft, is not within the purview of the FAA. As no FAA approval is to be granted, there must be no FAA approval implied or stated by you. If the Model 200 is "installed" in an aircraft, either for storage or in any other way, an FAA Maintenance Inspector must evaluate that installation to assure that no hazzard to safety is introduced by that installation. The Maintenance Inspector will determine the appropriate means of indicating approval of the specific installation.

Other Xenex models, which we understand are to be installed permanently, must be evaluated and approved under either Type Certification procedures in the case of incorporation into new aircraft design, or under Supplemental Type Certificate procedures in the case of retrofit into exiting, inservice aircraft. In either case, each separate approval would apply to a separate model of aircraft. Application may be made to an FAA Regional Office, as was described in our letter of September 14, 1981, to you.

The Technical Standard Order process does not apply, as no TSO exists for the equipment.

Sincerely,

Donald Armstrong,
For Keith D. Anderson,
Chief, Los Angeles Area Aircraft Certification Office.

Xenex Corp.,
Honolulu, HI, March 8, 1982.

Re: Installation and Placement of Xenex Portable Emergency Life Support Systems (Xenex PELS) Series 200.

Mr. Hugo Hofmann,
Chief Maintenance Branch, Federal Aviation Administration, Pacific Western Region, 218 Lagoon Drive, Honolulu, HI.

Dear Mr. Hofmann: Pertaining to the above referenced matter and our discussions last Friday, we propose placement of the Xenex PELS units in the following areas and by the following means:

A. Underneath the passenger seat next to the life vest, by identical or comparable means to that which secures and stores life vests.

B. Underneath the seat in front of the passenger, by identical or comparable means to that which secures and stores life vests.

C. In the overhead storage compartments, properly secured as, for instance, the life vests are stored underneath the seat.

D. Loosely stored in the overhead compartments where such compartments have doors to secure items stored in this area.

E. In a small separate compartment within the overhead compartment, where such compartments have doors to secure items stored in this area.

F. For the cockpit crew: Stowed in their coat closet in an appropriate container attached to the floor, wall or coat hanger bar.

As mentioned to you, the individual Xenex PELS units, for passenger use, weigh approximately one pound each. The weight varies slightly depending on the specific components selected by the airlines. A heavy duty version of the Series 200, for crew use, weighs approximately three pounds.

We would appreciate your early reply concerning the suitability of the aforementioned installations, A thru F, for the Xenex PELS units.

Sincerely,

Bertil Werjefelt, *President.*

Department of Transportation,
Federal Aviation Administration,
Honolulu, HI, March 30, 1982.

Mr. Bertil Werjfelt,
President, Xenex Corporation, 1400 Kapiolani Blvd., Suite C-4, Honolulu, HI.

Dear Mr. Werjefelt: We have reviewed all the information you supplied in support of your request to have locations approved for storage of the Xenex Portable Emergency Life Support Systems.

We understand the Series 200 model does not require any change to the aircraft design.

Of the locations you outline in your letter of March 8, we would prefer the overhead storage compartments for passengers' life support systems to include restraint as preferable to loose storage. For the cockpit crew, any container would be acceptable so long as it does not block other equipment. We would also want to evaluate any site the carrier proposes.

Your communications with a carrier must not indicate that the Federal Aviation Administration is endorsing your product. Also, there must be no indication that there is any regulatory requirement for this device. Our preference of storage areas would only apply to the local carriers for which this office has certificate responsibility. Any request for installation of storage means for the life support system must come from the carrier involved.

We believe this covers the areas outlined in your letter. If you need more information please let us know. There is very little we can do at this level on any of the other models your company is developing.

Sincerely,

JENNINGS O. LARSON, *Chief.*

XENEX CORP.,
Honolulu, HI, March 23, 1982.

Re: Our Phone Conversation Today's Date and our Letter to Mr. Hoffman dated 8 March 1982.

JENNINGS O. LARSON,
Chief, Flight Standards District Office, Federal Aviation Administration, 218 Lagoon Drive, Room 215, Honolulu, HI.

DEAR MR. LARSON: Per your request, we have enclosed herewith relevant communications with the FAA concerning our letter to Mr. Hoffman of 8 March 1982. You will note our request for assistance of 18 December 1981 from the FAA Administrator and his subsequent response to us of 29 January 1982.

In addition, as it concerns our communications with Mr. Hoffman, we have enclosed a letter from Keith D. Anderson, Chief, Los Angeles Area Aircraft Certification Office, dated 22 February 1982.

We trust these enclosures will be of assistance to you in response to our 8 March 1982 letter.

Very truly yours,

BERTIL WERJEFELT, *President.*

[Enclosure 2]

U.S. DEPARTMENT OF TRANSPORTATION,
FEDERAL AVIATION ADMINISTRATION,
Washington, DC, July 16, 1982.

Hon. NANCY LANDON KASSEBAUM,
Chairman, Subcommittee on Aviation, Committee on Commerce, Science, and Transportation, U.S. Senate, Washington, DC.

DEAR MADAM CHAIRMAN: This is in regard to the June 2 and 21 letters (copies enclosed) from Mr. Peter L. Trask to Mr. Craig Beard, which submitted questions for our response concerning S. 1770.

We understand Mr. Trask's letters were transmitted on behalf of Senator Inouye and for the express purpose of obtaining material to be made part of the record of the hearing on S. 1770, which was held on May 20. Accordingly, I am submitting the Federal Aviation Administration (FAA) responses to the questions to your Subcommittee. In response to the final question contained in the June 21 letter, which asked if we would care to make additional comments concerning other testimony at the hearing, we wish to make no further comments.

As you know, Mr. Beard, from the Office of Airworthiness, testified to the FAA's position on S. 1770. In addition, considerable man-hours were expended by the FAA in preparation for the hearing and in preparing the answers to Mr. Trask's June 2 letter.

In closing, I wish to reiterate that the FAA has thoroughly reviewed the issues raised by S. 1770, and I am satisfied that the current standards relating to the issues are adequate. We do not support the independent study called for by the bill and, in our view, the performance of such a study would call for the needless expenditure of funds at a time when fiscal prudence is clearly called for in every activity we undertake.

Sincerely,

J. LYNN HELMS, *Administrator.*

Mr. LEVITAS. I just have one question at this point. On page 9 of your prepared testimony, you indicate that the safety improvements that you have described could be provided for at a cost of about 15 cents per ticket, or something of that sort, as I recall.

How did you arrive at that figure?

Mr. **Werjefelt**. The 15 cents is a very generous estimate that we have made based on providing fire extinguishing means of what we consider an appropriate quantity and toxic fume protection, which must necessarily go hand-in-hand.

The method for calculating it is partly the cost of the equipment, and partly the added weight penalty for the aircraft. I will be glad to submit the calculations for how the assessment is made. We have also corroborated it with European and Far East airlines, that, in fact, the cost in some cases is down to less than 2 cents.

Mr. **Levitas**. I would appreciate it. It would be very helpful if we could have those calculations for the record in this hearing.

Mr. **Werjefelt**. I will be glad to submit them.

[The information received from Mr. Werjefelt follows:]

23 August 1983

The Honorable
Congressman Elliott Levitas
Chairman
Subcommittee on Investigations
and Oversight
Committee on Public Works and Transportation
B-376 Rayburn House Office Building
Washington, D.C. 20515

RE: Supplemental Materials Requested Concerning "Passenger Safety and Survivability in Airline Cabins", Hearings July 12-14, 1983 - Cost Calculations for the Carriage of Toxic Fume Protective Breathing Equipment on Board Airlines

Dear Congressman Levitas:

This letter is in reply to your request for supplemental information as referenced above.

The data which is provided herein is available in the manufacturer's technical publications. You will note that we have not submitted data for the 757 and 767 aircraft. However, the general fuel efficiency of these aircraft is approximately 30% better than, for instance, the 747 fitted with the older engines.

Calculations are based on pounds of fuel per hour per pound of added weight, 3,000 hour per year aircraft utilization.

Aircraft	Pounds of fuel per hour per pound of added weight
747	.050
L-1011	.0266
A-300	.0395
DC-10	.0253
707	.056

As an example, we have calculated the costs for a 747 with 442 seats based on an average trip of 3-hours and an average weight of the PELS System of 1/2 pound per unit which makes a total of 221 pounds of added weight. From this we find: 221 x 0.050 x 3 = 33.15 pounds of additional fuel. The poundage must be divided by approximately 6 to arrive at the number of gallons used to carry the extra weight. This amounts to slightly more than 5 gallons (33.15 ÷ 6). Current jet fuel prices range from 86¢ to $1.20 per gallon. We have, therefore, rounded out the figures to a total cost of approximately $6.00 (5 x $1.20). In addition, consideration must be given to the fact that aircraft may many times only be occupied to approximately 50%. (50% of 442 = 221). One must then divide the cost, $6.00 by 221 which, as you will note, is less than 3¢ per ticketed passenger. This is then the continuous ongoing cost of added fuel for carrying the equipment.

To the foregoing must be added the capital cost of the equipment which we, for the purpose of this example, have placed at $400.00 per unit (an absolute upper limit) for a total of $176,800.00. Further we will add an additional $200.00 for the purpose of installation, maintenance and inspection during the ten year lifetime of the equipment. We still presume a 50% occupancy rate equal to 221 passengers and 1,000 3-hour trips. We have not included interest or amortization as this will vary from airline to airline. However, we believe it is adequately covered in the $200.00 maintenance cost.

We find that 221 people (50% occupancy) make 1,000 3-hour trips per year for 10 years = 221 x 1000 x 10 - 2,210,000 ticketed passengers per aircraft over 10 years. Cost per aircraft therefore, is $400 + $200 = $600 x 442 = $265,200. Dividing this amount by 2,210,000 passengers equals 12 cents per passenger.

Thus, the total cost per ticketed passenger on flights of 3-hours is approximately 15¢ (12¢ + 3¢). Please note, however, that the average flight is much shorter than 3 hours. Therefore, the cost is even less - we estimate the average cost to be on the order of 5¢, especially when consideration is given to volume production as a means of reducing the $600 total equipment cost.

I trust the foregoing is sufficient for your purposes and that in light of the facts and problems and the concomitant insignificant costs for solutions to same, you will be further encouraged to continue your efforts for improvements in aviation safety.

Sincerely,

Bertil Werjefelt
President

Enclosures

cc: John P. O'Hara
Staff Director and Counsel

Mr. LEVITAS. One of the statements you made in your prepared testimony really struck me because it is so true. You said that the travelling public mistakingly assumes they already have the type of protection in an airplane of the sort that they don't have, but that could be available.

But the assumption is it is already there, when, in fact, it is not. I think that is a very important fact that we need to be aware of, and the public needs to be aware of. I would add to that what makes it even more dramatic is that it could be provided quickly and inexpensively.

Yet for whatever reasons, FAA has chosen not to make the necessary regulations that would bring this about. Mr. Molinari.

Mr. MOLINARI. Thank you, Mr. Chairman.

Referring first to the PELS system, could you tell us whether the system is in use today? Have you sold any of these units?

Mr. WERJEFELT. Well, we have let out some laboratory samples, I should say, preproduction samples. Our work in this is to develop it and license it to independent industry people who are competent in marketing such merchandise.

My understanding is we will have equipment available on a production scale by September/October of this year.

Mr. MOLINARI. When did you complete the development of the system?

Mr. WERJEFELT. It went through a few evolutionary processes trying to work with the FAA, where we, in one case, had a combined system with the existing oxygen mask, because that, at that time, was the only thing they would accept.

So in essence, the system was available—don't quote me on this—I think March, April or something, of 1980 or 1981.

Mr. MOLINARI. Do I understand, therefore, that the system now which would take the vented air supply system has been approved by FAA?

Mr. WERJEFELT. No. I think they specifically sent us a letter, saying that they have not approved it. But they have given procedures to me which would permit us to go ahead and install it in aircraft if there were operators who chose to take the system on.

Mr. MOLINARI. It wasn't the same type objection that it was to the oxygen system that you have on the plane?

Mr. WERJEFELT. I am not sure I understand——

Mr. MOLINARI. My understanding was that the original system that you developed would have been hooked into the oxygen system on the plane. FAA said they wouldn't approve that.

Did I understand you correctly?

Mr. WERJEFELT. That is the essence of it, yes. In other words, we combined our technology with the existing oxygen for decompression purposes to meet the need of toxic fume protection onboard. They would not approve that as such.

However, what you saw here on the screen, which is an autonomous system, an individual unit. Again they did not approve or disapprove of this.

But, they finally, after a lot of hassling, came up with a procedure, for which we could be permitted to put it onboard aircraft.

Mr. MOLINARI. Breathing of fresh air?

Mr. WERJEFELT. Yes. Now, I should point out that what you looked at there is an interim evolutionary measure for providing protection now, not 10 or 15 years down the line. Obviously, as new airplanes are coming out, you would prefer to have a more sophisticated system, an automatic drop down system or something similar.

But if we are going to wait for another 15 years, which probably would be about the time it would take to retrofit, and get a new fleet in service, then you would have the automatic drop down system. We are trying to fill the gaps in between, the 15 years.

Mr. MOLINARI. Have you addressed the problem that we have seen during this week in the hearings where a survivor testified that the smoke was so thick that he couldn't see his hand in front of his face?

The information that we received indicated that there were two Royal Canadian Reserve pilots on the plane who perished. They were found in the aisle to the rear of the plane over the wing exits. It was presumed that they were unable to find the exits, presumably because of the dense smoke, and became lost.

Is your company doing anything about addressing this problem?

Perhaps there could be some kind of a line or whatever so that in a situation such as that they could grab onto something which would guide them to an exit. That seems to be something that I haven't heard anybody talk about.

I am wondering why.

Mr. WERJEFELT. We haven't addressed it either. I think it sounds like a good idea. Something that would help guide you out of the aircraft.

It would certainly apply in some cases.

When you have a crash, however, there is so much debris in the aircraft that it would be difficult to find your way out of that. The chairs come loose and fall on top of you and so on.

But our approach to the problem of impaired visibility and fire problems is two-fold. If you provide toxic fume protection, then you can fight the fire in a very incipient stage with plenty of firefighting equipment.

There is none there now.

Mr. MOLINARI. I understand.

Mr. WERJEFELT. That would eliminate a lot of the problems we are now looking at. In addition, smoke and evacuation capability, is not a problem until you get on the ground.

If you have these hoods on, it really isn't a problem because you can take your time, to get organized and get out of the plane.

I am not talking about a plane now that went off the end of the runway and is in the woods.

Mr. MOLINARI. I understand. Similar to the Air Canada is what you are referring to.

Mr. WERJEFELT. Right. Similar to that circumstance. Once you have protective breathing equipment, a lot of the problems are eliminated.

You are calmed down because you have air, you are not panicking because you are choking and so on. So as far as finding your way out——

Mr. MOLINARI. That is the other part of the equation.

Mr. Werjefelt. Yes.

Mr. Molinari. That gives you several minutes. How many minutes did you say that hood would give you once you disconnect?

Mr. Werjefelt. Civil Aeromedical Institute tested it out. It is from 2½ to 8 minutes. It depends on your respiration rate at the time.

I think they had a good college athlete on an ergometer doing very high physical exercise. He used up the supply in 2½ minutes. Another person in a sendentary position used it up in 8 minutes.

Mr. Molinari. It seems if one is in a semipanicked state, they might have a tendency to hyperventilate, breathe faster. Would not that use up the supply even quicker?

Do you know if they took that into consideration?

Mr. Werjefelt. That was taken into consideration in the 2½ minutes.

Mr. Molinari. That is the other extreme.

Mr. Werjefelt. Right.

Mr. Molinari. Assuming you had 2½ minutes, that is not a great deal of time if you have a plane full of smoke and if we had a loaded plane. Here there was only 41 passengers, approximately 40 percent or less of the seating capacity. Plus luggage.

I can see where that might be a problem. Let me ask you this. You have a brochure here put out by the company.

Mr. Werjefelt. Yes.

Mr. Molinari. On the back of it, following is a list of some of the common lethal gases associated with aircraft fires and their lethal concentrations. Are you familiar with that?

Mr. Werjefelt. Yes, I am.

Mr. Molinari. Do you know at the bottom of that after you list the various gases, you say at these nominal concentrations, even a few breaths are lethal. Death results after a few seconds. Minutes, at most.

On the Air Canada plane we do know that there was hydrogen cyanide. We do know there was carbon monoxide. Yet from the time that the smoke was discovered to the time they landed, it was approximately 10 minutes.

Of course, it was in some cases another several minutes before passengers were able to get off the plane. I am wondering how that squares with your statement here that a few breaths would be lethal.

Mr. Werjefelt. First of all, the data that you are reading has been obtained from researchers at the British Civil Air Ministry. They are not my words.

These are people who have worked extensively in the field. I think statements there would be corroborated by the Civil Aeromedical Institute.

As to the distribution of a gas in a vessel, as we call it, as you would consider the fuselage to be, the gases that come out in the course of combustion in this case are not in uniform distribution.

In other words, the mixture is not like oxygen and nitrogen. It is difficult for me to speak as to why. Somebody might have been sitting next to someplace in particular that was burning and giving off a greater concentration of it, and therefore have been debilitated immediately. In another area someone may have received a much lesser concentration of it.

I think if the FAA were serious about this whole thing they should just go burn a couple of old fuselages and measure what is in there.

Mr. **Molinari**. I agree with that. I think that is something the chairman has been attempting to do for some time.

One of the points of interest, while we have you here, I would like to question you about is the fact of the spread of diseases. I am not talking now about smoke and fire and lethal gases—but influenza and similar viruses.

Have there been any studies that you have had referenced indicating any extreme situations where there has been a spread of disease on a plane because of an ill passenger?

Mr. **Werjefelt**. There has been very little done. There are two things that are known.

In the past they could trace small pox and I believe influenza according to the air traffic routes. Small pox would occur in one place and they would trace it depending on how much air traffic was coming into the area from a contaminated region.

The only case that is well documented is a case up in Alaska which happened to be a fluke situation that CDC has documented.

Those are the figures we are citing in the prepared testimony. There was one woman on board an aircraft which was delayed because of an engine problem at Kodiak, AK—it is a small community with very little air service. I think twice a day or something like that. In the course of the delay, which I believe was a couple of hours, a number of the people became sick. In fact, 72 percent of them, I believe.

That is the only well-documented case there is on the spread of airborne disease.

Mr. **Molinari**. Do you know what the nature of that illness was?

Mr. **Werjefelt**. Influenza. I guess the people were quite lucky. Nobody died in that. But it was a bad case of influenza by what I was told by virologists who have studied it.

Offhand, I can't think of any other cases other than there have been some cases of food poisoning. We did receive some comments to the petition that we filed with the FAA where one man had been on a flight from the Far East, I forget what airline. There were some refugee children on board and he evidently saw that some of them had chicken pox. I believe it was chicken pox.

The incubation period was 12 days. He came down with it 12 days afterward and his wife came down with it 13 days afterward—that being the lagtime between the two exposures.

Because of people coming from different places, getting on a plane and then scattering to the wind, it has been very, very difficult to get a handle on it.

Mr. **Molinari**. I have one last question. One of the objections that we seem to be faced with when we are talking about portable equipment on board for whatever reason is the question of pilferage.

We have heard stories that on some air routes where they are near a lot of boating facilities, that the lifesaving equipment like the vests have been stolen in rather large numbers.

Have you run into this problem as an objection to some of the equipment you are developing?

Mr. WERJEFELT. Yes; the lifevests are frequently cited as a pilfered item on board an airplane. It can be overcome very easily, however.

There is no reason why the lifevest shouldn't be dropped from on top just like the oxygen mask is. I think that argument is really ludicrous. They should just put it up there and stop discussing it.

Mr. MOLINARI. But with respect, for example, to this pack we saw that would be in a pouch in front, was there concern expressed that there would be theft involved?

Mr. WERJEFELT. No question about it. Certainly; they have pointed that out.

We can store it up on top in a special compartment in the overhead storage, or there is enough space between the PSU's, passenger service units, the modules that have the lamps and air outlets and so on, there is enough space between them to have them drop down from there.

So if there is a will, there is a way.

Mr. MOLINARI. Thank you for some very provocative thoughts here. I appreciate your testimony very much. Thank you.

Mr. LEVITAS. Thank you, Mr. Molinari.

Dr. Rowland.

Mr. ROWLAND. Thank you, Mr. Chairman.

I believe we heard from Mr. Grubbs yesterday that he first noticed smoke coming out of a vent on the right-hand side of the aircraft. I believe that your mask works off of the vent system in the aircraft.

Is that right? You plug it into the vent overhead?

Mr. WERJEFELT. This is an interim measure. Yes. We obviously would like to see in the long term that, perhaps a separate ducting system be put in, that specifically addresses the issue from a lifesaving standpoint.

Mr. ROWLAND. Well, in the instance of the Air Canada, smoke was in the venting system. Then using your mask wouldn't have helped in that particular instance, or would it?

I am asking for information.

Mr. WERJEFELT. Well, the venting system is an intact, integral system. It would work very well.

But the trouble is that some of the new aircraft have recirculation fans which suck a fair amount of air out of the cabin back into the system.

In order to overcome that, you just turn off the fans so they are not sucking in that air. You have positive pressure of outside air in the system.

It is very easily overcome.

Mr. ROWLAND. There have to be some changes made then in the aircraft presently being used to ensure that smoke would not get into the system your mask would be hooked to?

Mr. WERJEFELT. No. That is not so. No changes have to be made. The pilots merely have to turn off the recirculation fans.

Mr. ROWLAND. I guess what I am trying to find out is with reference to the Air Canada plane. Is the vent from which the smoke was coming contiguous with the vents that the air comes through the outlet over the passenger?

Mr. WERJEFELT. Yes. They are fluidicly connected.

What I am saying is, if you are familiar with the pressurization and ventilation system on an aircraft——

Mr. ROWLAND. I am not. That is why I am asking you.

Mr. WERJEFELT. I will try to explain it to you. On the compressor stage of the turbine, before any fuel is injected into the air, you can take-off air for the cabin. Bleed air, it is called.

This is what is used to provide the life support system in the cabin, pressurization and fresh air ventilation. As that air goes through a process of conditioning. It becomes hot because of compression and has to be cooled before it is brought into the cabin.

As it is being brought into the cabin, and you have to have a certain minimum, I believe it is around four cubic feet per person per minute to keep people alive, but assuming you bring in seven or eight cubic feet of it per person, per minute, then in order to provide for a feeling of comfort and ventilation, a little moisture in the air, you add to that fresh air supply another 10 cubic feet which is sucked in from the cabin.

So at that point as the main duct comes down into the cabin, putting out air, you have a mixture of the two. In order to have our system work, the pilots need merely turn off the recirculation fan.

Older aircraft do not have any recirculation fans. It is just the recent new aircraft that do.

Obviously, the manufacturer/licensee who would be putting it out would put out a notice to the airline as to the procedure to be used, and expect that they provide you fresh air as they are capable of doing.

Mr. ROWLAND. Then if the pilot did cut off the air that was coming from the cabin, would the air that would be used then come from outside of the aircraft during flight?

Mr. WERJEFELT. When you are flying, the air for pressurizing the aircraft comes from outside.

Mr. ROWLAND. What about the air that is breathed in the cabin? Does part of that come from outside, too?

Mr. WERJEFELT. Yes, it must.

Mr. ROWLAND. That leads to my next question. We know that at sea level that the gas is about 20 percent oxygen. What about at 30,000 feet? What percent of the air there is oxygen?

Mr. WERJEFELT. It is the same percentage, but it is a lesser quantity of it because of reduced pressure. So in order to obtain the same quantity of oxygen, you just have to breathe more, or raise the pressure to sea level equivalent.

The heart has to pump more to get it around to the different organs in the body. The mixture between oxygen, nitrogen, and some of the other rarified gases is the same up to, I forget, 100 miles, I believe.

Mr. ROWLAND. I see. I didn't know that.

The mask that you have, would you consider that a semiclosed system or a closed system?

Mr. **Werjefelt**. It is both depending on which way you are operating it. When you are hooked up to the ventilation system, it is an open circuit system. As you disconnect, it is a closed circuit system.

Mr. **Rowland**. Would you mind repeating that? I am not sure I understood.

Mr. **Werjefelt**. You were asking me is it an open or closed system.

Mr. **Rowland**. Once you put the mask on, is the system a closed system, or semiclosed?

Mr. **Werjefelt**. It is an open circuit system. In other words, you are continuously provided new fresh air approximately 3 cubic feet per minute based on current ventilation equipment on the aircraft.

That air is vented out through the hood. When you disconnect it, all the valves close off. So then you have a completely closed system.

Mr. **Rowland**. You have valves that make it an open system so that carbon dioxide escapes; is that right?

Mr. **Werjefelt**. Absolutely. I am not the only one that has worked on establishing the flow rates. They have been established according to the CAMI standards and some of the industry people involved in it have worked on it.

I believe we have had the lowest rate, down to, I think below two cubic feet. The highest rate is on the order of four cubic feet.

Mr. **Rowland**. Thank you, Mr. Chairman.

Mr. **Levitas**. Thank you. Let me ask you a couple of other questions.

You are very familiar with the air circulation systems on aircraft such as the DC-9, I take it, from the work you do; is that correct?

Mr. **Werjefelt**. Well, I would say reasonably so. Yes.

Mr. **Levitas**. When Mr. Grubbs testified yesterday that the smoke was coming out of the air return panel, which I gather are the panels that are up just under the bins against the wall, I was sort of struck by that because it didn't seem to be a likely place for smoke to be coming out. If it were the air return area normally the circulation would be going in the opposite direction.

Do you have any explanation or theory as to what was happening?

Mr. **Werjefelt**. The air return will stop functioning when you close the outflow valve. If you turn off air conditioning packs, it would also stop flowing and be reversing out of there.

So if any contaminated air had come into those ducts, it would start coming back out that way. In the descent mode that they were in at the time, I would assume that would have been what was going on.

Mr. **Levitas**. You have clearly done a lot of work with CAMI in Oklahoma City. What is your impression of that operation and the contribution that they make?

Mr. **Werjefelt**. I am super-impressed by the really loyal and dedicated employees they have there. Very impressed.

I think as an observation, there are a lot of people who have been frustrated in their efforts. They have been doing very meaningful research but are not getting it out to the market through the proper channels.

Mr. **Levitas.** Do you know of any other single facility that does the type of work that they do at CAMI?

Is there any place in NASA or the military that is duplicating what they do?

Mr. **Werjefelt.** I think there are several around that are doing it. I don't know of duplication, per se. Some necessarily must overlap.

I am sure NASA has a facility to do that work.

Mr. **Levitas.** The reason I ask that is this. I am very impressed also with what I have seen at CAMI. I also sense the same frustrations that some of the people have along the lines you have indicated.

But it has been also my impression that CAMI was a rather accessible source to the industry and to the public as far as the work that is being done, whereas the military and NASA does not seem to be as accessible.

Yet, I hear rumors, actually more than rumors, but I hear rumors there is some consideration being given to abolishing CAMI. Do you think that there would be any negative results as far as the flying public is concerned if CAMI were to be abolished?

Mr. **Werjefelt.** I will give you my candid opinion on it. I would hate to see it go. They have certainly been most helpful in our work. However, from the standpoint of how certain others—FAA—use it and information that is developed at CAMI, they could do without it. They don't use it anyway.

I think that is a shame.

Mr. **Molinari.** Mr. Chairman, would you yield for a moment?

Mr. **Levitas.** I would be happy to.

Mr. **Molinari.** I would like to second what you have said, Mr. Werjefelt, and what the chairman has said.

I was with the chairman on the trip to Oklahoma City. I was very impressed by the spirit of dedication and expertise and professionalism that we saw on that visit.

I say for the record that I just heard this morning that FAA has a plan afoot to have wholesale transfers of the personnel at CAMI, and this probably follows up, Mr. Chairman, on what you have been saying, we have had no discussion about this.

We got it from independent sources. Which would be, in my judgment, a tragedy. Let the record speak for itself, but as far as this member of Congress is concerned, I consider, and I hope the chairman would join me in that, if there is such a movement, FAA is going to have to answer to us on that score.

Mr. **Levitas.** Thank you, Mr. Molinari.

I think it would be of serious magnitude that would adversely affect the safety of aviation transportation in this country. While I would have to agree with Mr. Werjefelt's observation that too often the work they do is not being implemented as it should be, I think we are going to see some changes made in that regard. And given the state of the lack of implementation, of obvious safety measures by FAA, to eliminate CAMI in the process, I think would be outrageous. And I think it would be just exactly the wrong thing to communicate to the industry and to the American traveling public.

One last question. Do you have with you one of those hoods, Mr. Werjefelt?

Mr. **Werjefelt**. I am not sure whether I do or not. No, we don't. We would be glad to send one.

Mr. **Levitas**. At some point I would like to actually see one of those hoods to get the experience of being able to get a sense of the ease with which it might be utilized. Well, if there are no further questions, I would like to express my appreciation to you. Your testimony has been extremely informative.

As Mr. Molinari says, the idea is very provocative. Thank you very much for being here today.

Mr. **Werjefelt**. Thank you.

Mr. **Levitas**. I might say that I was just telling Mr. Molinari that if I had a choice between flying on one of two airlines going from point A to point B, and one of them had that type of system in it and the other one didn't, I would fly the one that did.

Mr. **Werjefelt**. Your comment is very well received. Thank you.

Mr. **Levitas**. Thank you, sir.

The next witness is Mr. Thomas Ashwood, who is first vice president of Air Line Pilots Association. He is accompanied today by Mr. John O'Brien, director of engineering and safety department.

I notice that I have here, gentlemen, a statement of Captain Henry Duffy. And there has been a change?

TESTIMONY OF THOMAS ASHWOOD, FIRST VICE PRESIDENT, AIR LINE PILOTS ASSOCIATION; ACCOMPANIED BY JOHN O'BRIEN, DIRECTOR, ENGINEERING AND SAFETY DEPARTMENT

Mr. **Ashwood**. Yes, Chairman. In fact, Captain Duffy asked me to render his apologies to you and the committee. A death in his family caused him to return to Georgia. I am pinch-hitting for him today.

Mr. **Levitas**. Well, fine. I am sorry to hear the circumstances under which his absence was necessitated. We appreciate your participation. I wonder if you would raise your right hand, Mr. Ashwood, Mr. O'Brien.

[Witnesses sworn.]

Mr. **Levitas**. Thank you very much. You may proceed. I take it that you are going to be giving the testimony, and the testimony that you will be giving is your own, even though Mr. Duffy's name appears on it?

Mr. **Ashwood**. That is true, sir. I am speaking for myself.

Mr. **Levitas**. Thank you. You may proceed.

Mr. **Ashwood**. Thank you, Mr. Chairman.

I have been an airline pilot for some 19 years. I have been a pilot for 28 years. I know that my 34,000 fellow airline pilots who are members of ALPA share my belief that there is no more important issue than the subject of these hearings. The subject of course is aircraft safety. I think properly that should read "people safety" because that is what we are talking about.

With me today, as you pointed out, is Mr. John O'Brien, who is our director of engineering and air safety.

Our written testimony covers a wide range of cabin safety and crash survivability concepts for your consideration. Rather than summarize that document in my allotted time, I would like to discuss with you the broader implications of government rulemaking on airline safety. Recent analysis by the Federal Aviation Administration that it will publish proposed rulemaking by next year on a series of vital safety issues is genuine good news to us in a time we haven't had too much good news.

We could complain, and complain bitterly and justifiably, in fact, about the length of time it has taken the FAA to move on these issues. Especially since ALPA first raised many of them in the mid-sixties. But to complain in that fashion would only be self-serving and we would rather deal with the matter on a more positive basis if we could.

The important fact as far as we are concerned is that Mr. Helms has got the process moving and we do applaud him for that. Realistically, however, and we do live in the real world, it will be some time in the next decade before all of the new rules are fully implemented on every aircraft. We have heard testimony to that effect from previous witnesses. But that of course assumes that the rules themselves first clear the cost-benefit analysis hurdle. That alone will not be easy.

Ever since ALPA and others first recommended reducing the toxicity and flammability of cabin interiors or strengthen seat structures or using antimisting devices and self-seating, breakaway fuel line fittings, providing adequate flotation devices, and this is just a short list of a longer one, there has been but one response from the industry. It is a good idea but it costs too much.

We have heard this broken record response in good times as well as lean times. Lord knows in the bad times for the airline industry today it will surely be amplified a thousandfold. The cost-benefit analysis attempts to depersonalize what are essentially realistic decisions of life and death.

Now, I am not certain that mortals are capable of performing such a task. But in a society that so values human life we must simply insist that in whatever equation is used sufficient value is placed on the human side. The entire Nation earlier this year watched and prayed in wonderment at the struggle of a man we didn't even know, Barney Clark, as he fought for a few more months of precious life. The dollar cost, which was very high, was the least of our concerns as a nation. That was as it should be. Yet we as a nation will now spend months, and even years, debating whether requiring adequate life preservers on every aircraft costs too much.

The problem is that we don't know whose life will be saved because of a life vest. It could be any member of this committee or our next door neighbor. If we knew that, I am certain we would all agree that cost was no object. Maybe that is why airline pilots are so concerned about safety. There is an old saying that a pilot is the first one to arrive at the scene of an accident. And in an association as small as we are, and I guess we are small in the overall fabric of trade unions, you either know the pilot that was in the accident or you know somebody that knows him. He is part of our family.

By the same token those who mourn the victims of the Air Canada fire or tend to the burned survivors will forever wonder whether the installation of a simple smoke and fire detector would have saved them tremendous pain. I am certain this committee doesn't want the task of explaining to these human beings how saving money was more important.

Mr. Chairman, our dilemma is that cost-benefit analysis demands that the question of the value of a human life not be left to philosophers. It must be decided by legislators and government officials such as yourselves. What we Americans, professional airline pilots, ask of this committee is to speed up the process of making those decisions in any way humanly possible.

It has taken 25-plus years to even decide to consider the rule. I would like to repeat that. Twenty-five years to decide whether to consider a rule. It must not take any longer than necessary to decide to adopt these rules. Even if the Congress were to speed up the process, there are some things that shouldn't wait. The Congress should act immediately on those matters that really don't need further study, or require great amounts of time and expense to install.

ALPA would like to suggest four areas the committee should direct the FAA to address quickly. First, smoke and fire detectors should be installed in lavatories, galleys, and cargo areas of every commercial aircraft, and now. Have it done now.

Second, exit lights should be required at the seat level or below that level so that the path to safety will not be obscured by smoke. That needs to be done now.

Third, no commercial aircraft should be dispatched if any of its emergency lights and doors are not functioning properly. There should be no discretion left to anyone on this subject. That should be a mandatory no-go item.

And fourth, and lastly in this very, very short list, life preservers should be required on every commercial aircraft seat. Seat cushions are just not adequate to the task. We would prefer the preservers be placed in front of every passenger, but that might require new seats. So let us get the life preservers on every aircraft first and then argue about where is the best location later.

Basically, on the same subject of survivability in water, every aircraft that flies on extended overwater flights should be required to have sufficient life rafts for the plane's passenger capacity. I believe that is a requirement on ships and ferryboats and other such modes of water transport. At the present time 12 airlines have FAA waivers from this requirement, and we believe the Congress should tell the FAA to revoke those waivers. Stated simply, we have aircraft, airlines flying now with passengers on extended overwater flights without any life rafts.

As this committee well knows, this would only be a beginning. There is much more that must be done to improve cabin safety and crash survivability. Let us not bemoan the fact that there is so much to be done that we don't know where to begin. We know where to begin. Let us begin, and let us begin now.

Mr. Chairman, the members of ALPA congratulate this committee for conducting these hearings so as to focus public attention on a problem which we are very close to. Now, I realize, sir, that is a customary statement for witnesses that appear before you to say. But I must underscore the fact that we mean those congratulations and our thanks and gratitude is very deep and sincere. We are confident that you in particular will not let another 25 years slip by without changes that will make the safest mode of transportation even safer than it is.

By way of I guess a stop press item, as I left my office to come here I was informed that at this particular time today the FAA are contemplating or have already finished their contemplation on changing the rules on part 139 of firefighting equipment and requirements of airports. The report I received was alarming in that they were contemplating removing, or not requiring any firefighting equipment at A class airports which are used by air carriers, commuter carriers mostly, and reducing by 50 percent the requirements at B size airports, medium size airports. I hope that the report to me was incorrect, but I suspect that it wasn't.

I am available to answer any questions you have, sir.

[The prepared statement of Capt. Henry Duffy follows:]

STATEMENT OF
CAPTAIN HENRY DUFFY, PRESIDENT
AIR LINE PILOTS ASSOCIATION
BEFORE THE
SUBCOMMITTEE ON INVESTIGATIONS & OVERSIGHT
COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION
U.S. HOUSE OF REPRESENTATIVES
JULY 14, 1983
AIRCRAFT CABIN SAFETY AND CRASH SURVIVABILITY

Good afternoon, Mr. Chairman, and members of the Subcommittee. I am Captain Henry Duffy, President of the Air Line Pilots Association. Accompanying me today is John O'Brien, Director of our Engineering and Air Safety Department. We are testifying today on behalf of the 34,000 ALPA members who fly for 46 airlines. We commend the Subcommittee for its ongoing concern about Air Carrier Cabin Safety.

The Air Line Pilots Association has been actively involved in various aspects of cabin safety and accident survival for over 30 years. The majority of this activity has centered on the recognition of cabin safety inadequacies with recommendations to the appropriate authorities for the correction of these problems. Many cabin safety problems appeared, or became more acute, with the introduction of turbojet aircraft in the early 1950's. The introduction of jet aircraft brought about higher takeoff and landing speeds, greater passenger loads, and larger fuel loads to meet the greater fuel requirements for the jet engines. While these characteristics can contribute to the difficulty of surviving an accident, the increased structural strength required by the higher speeds and greater altitudes of modern jet aircraft has resulted in a much tougher fuselage which often remains intact through many types of accidents. Unfortunately, cabin interior crashworthiness standards have not been updated to take advantage of the increased airframe strength. Our comments today will center on those safety areas which we feel are in need of modification in order to increase the passenger's and crew member's ability to survive an accident. These items are cabin crashworthiness, fuel system crashworthiness, cabin fire safty, cabin fire survival and evacuation, airport crash/fire/rescue (CFR) and overwater survival.

Since the introduction of large jet powered transport aircraft, there has been a relative increase in the injury annd fatality rate during otherwise survivable accidents. This is caused, to a great degree, by cabin interior furnishings which break loose at relatively low impact loads and injure the passengers and crew. Some of the cabin interior furnishings which fail include the galleys, coat closets, overhead panels, overhead carry-on baggage bins, seats, and class division panels. While the failure of any one of these cabin components might not prove fatal or injurous, it can certainly hamper or prevent egress from the aircraft during an otherwise survivable accident. Often these components fail well below the human G tolerance level. (A "G" is defined as 1 gravity, a body at rest experiences "1 G". A body which is experiencing a 2 G deceleration is experiencing a momentary increase of perceived resistance or weight twice that it would normally experience at rest. G's are normally measured in three axies; up/down, forward/backward, and sideward.)

According to the U.S. Air Force design guide specifications, human G tolerance limits are as follows:

Upward	25 G
Forward	45 G for .1 sec or
	25 G for .2 sec
Sideward	9 G (11.5 with shoulder harness)
Downward	15 G
Rearward	45 G

In contrast, the Federal Aviation Administration (FAA) in Federal Aviation Regulation (FAR) Part 25.561, which defines G loading requirements for transport aircraft interiors, specifies the following G levels as the minimum:

Upward	2 G
Forward	9 G
Sideward	1.5 G
Downward	4.5 G

In 1969 the FAA issued a Notice of Proposed Rulemaking (NPRM) 69-33, which was later withdrawn, to upgrade cabin crashworthiness requirements. The FAA Office of Aviation Medicine recommended these minimum limits:

Upward	20 G
Forward	20 G
Sideward	10 G
Downward	20 G
Rearward	20 G

while the Flight Safety Foundation recommended:

Horizontal	20 - 25 G	for .2 to .3 seconds
Vertical	15 - 20 G	
Lateral	10 - 15 G	

There is an obvious discrepancy between what is presently required by the FAA and the FAA Office of Aviation Medicine, U.S. Air Force, and Flight Safety Foundation recommends. This difference is partially due to the fact that the basis for the FAA requirements in FAR Part 25.561 are based on the aircraft and technology available over 30 years ago, before the jet transports came into use.

When a transport airplane experiences greater than normal G loadings that are still within human tolerance levels (such as an aborted takeoff with the airplane sliding off the end of the runway at slow speed), it is common for the cabin furnishings to fail. During this sequence seats fail, overhead panels fall, galleys come apart, and carry-on baggage falls out of its compartments. Due to the cabin breakup, passengers are injured or killed and emergency egress from the aircraft is severely hampered or even prevented. The National Transportation Safety Board conducted a special study in 1981 titled, "Cabin Safety in Large Transport Aircraft", which resulted in seventeen specific conclusions. They determined that the current requirements as specified in FAR Part 25.561 are inadequate and many improvements can, and should, be made to cabin crashworthiness.

The Air Line Pilots Association recommends that the FAA issue an NPRM to revise FAR Part 25.561 to upgrade cabin interiors to meet the following G loading requirements:

Longitudinal	20 G
Vertical	20 G
Lateral	10 G

These are in agreement with recommendations from the Flight Safety Foundation, National Transportation Safety Board (NTSB), U.S. Air Force and U.S. Army requirements, and available technology.

Another area which directly influences the ability of passengers to survive an otherwise survivable accident is the crashworthiness of the fuel system. Modern air carrier aircraft carry so much fuel that at takeoff 30% to 40% of their total weight is fuel. For example, a Boeing 727 Advance has a maximum takeoff weight of 184,800 pounds, of which 53,394 pounds is fuel. This is 29% of the total airplane weight. A fully loaded Boeing 747 weighs 710,000 pounds of which 312,384 pounds or 44%, is fuel. If this fuel is ignited during an otherwise survivable accident, such as an aborted takeoff, survival of the passengers becomes doubtful due to the very short evacuation time.

On March 1, 1978 a fully loaded McDonnell-Douglas DC-10 aborted a takeoff from Los Angeles, California due to a tire failure. The airplane skidded off the end of the runway and one main landing gear broke as the aircraft traversed the soft uneven ground. This landing gear strut ruptured the left fuel tank of the aircraft. (NTSB report NTSB-AAR-79-1) A fuel fire erupted destroying the aircraft. Two passengers out of a total of 200 passengers and crew on board were killed. The NTSB attributes this low death rate to rapid and efficient response to the accident by the Los Angeles airport CFR services. The post crash fire, is the most serious threat to survival of the passengers during on otherwise survivable accident. This accident did not turn out to be a catastrophe because the last line of defense, the CFR services, responded in an ideal way. In many other accidents, this has not been the case; The passengers survived an accident only to perish in the ensuing fire.

The Air Line Pilots Association believes that there are various engineering and construction techniques that can be used to minimize or slow the propagation of these fuel fed fires after an accident. The FAA is currently conducting a research project in this area that shows great promise. This project involves the use of a fuel additive that will prevent the fuel from misting, as often occurs when a fuel tank is ruptured. If the fuel does not mist, it becomes much more difficult to ignite, thereby providing more time for passengers to escape from the aircraft. Technical problems that must be overcome and the cost of the additive will be difficult for industry to accept, however, the benefit of the additive may well prove to be such that the cost will be acceptable.

Efforts must be made concurrent with this program to improve the fuel system crashworthiness since antimisting fuel might not prove practical and it will not prevent fuel fires in all situations.

The U.S. Army has established design criteria for breakaway self-closing fuel connections, increased crashworthiness of fuel tanks, and greater protection for crew members and passengers in both their rotor wing and fixed wing aircraft. Their experience with these upgraded requirements has proven extremely beneficial. Since the introduction of this program no deaths, to our knowledge, have been caused by thermal injuries.

Some, if not all this technology, is applicable to transport aircraft. There have been many air carrier accidents, such as the ONA DC-10 accident at JFK where the fuel line disconnect valves would have prevented destruction of the aircraft because it would have stopped the fuel flow when the engine came off the airplane. Increasing the fuel tank rupture resistance, combined with antimisting fuel, could also prevent many fuel fires and reduce the intensity and severity of the other fire that might occur.

The Air Line Pilots Association recommends that the FAA actively continue their research with antimisting fuel and review with aircraft manufacturers and industry how best to upgrade transport aircraft fuel system crashworthiness. Reduction of the post crash fuel fire hazard will do the most to prevent the death of passengers and crew members in otherwise survivable accidents.

While the post crash fire hazard is one of the most significant in terms of death causation in survivable accidents, the in-flight fire hazard is no less serious due to the lack of escape routes available to the passengers and crew and the limited fire fighting capability on board the airplane. There are four areas that must be addressed when cabin fire safety is discussed; these are fire prevention, detection, extinguishment, and survival enhancement.

The effort to prevent fires in the cabin during flight is extremely important, but it is not, and cannot, be the only measure taken to protect passengers from the cabin fire hazard. When cabin fire prevention is attempted, three separate areas must be considered. Aircraft systems design must be accomplished with fire safety in mind to minimize the chance of fire ignition and propagation. Aircraft materials must be chosen which are fire proof or resistant and produce minimum amounts of toxic gases and smoke. And finally, rules and regulations must be adopted to ensure that acceptable minimum safety standards are determined, maintained and updated as required.

If the fire prevention measures fail and a cabin fire does start, then early detection offers the best chance for successful extinguishment. At present, cabin fire detection is based on detection by passengers and crew using sight and smell. Unfortunately, this does not always ensure a fire will be discovered in time.

Air carrier aircraft are now required to have smoke detectors only in certain types of cargo compartments. This is because there is no access to these compartments in-flight and timely discovery is important if cargo compartment extinguishing systems are to be effective. These cargo compartments usually have some type of automatic or manual extinguishing system and the ability for the pilots to control the compartment ventilation. There are areas within the passenger cabin that if a fire were to occur, discovery might not be made in time to successfully combat the fire. For this reason, this Association recommends that smoke detectors be made mandatory in the galley area, lavatories, and any area not easily seen during flight, such as coat closets. This will provide an early warning of potentially devastating fires.

When a fire is discovered, on board extinguishing systems _must_ be employed effectively because it takes an air carrier aircraft at cruise at least 15 minutes to make an emergency descent, approach, and landing in the best conditions. A cabin fire can prove fatal in less than 15 minutes if it burns uncontrolled. On board fire extinguishment is provided by hand-held fire extinguishers which require that the user be trained not only in their function but also their operating technique. Air carrier aircraft are required to carry approved extinguishers suitable for the type fire to be expected according to FAR Part 121.309. FAR Part 25.851 states that the minimum number of fire extinguishers to be carried shall be as follows:

7 through 30 passengers	1
31 through 60 passengers	2
61 or more	3

According to this requirement, most transport aircraft now carry three fire extinguishers in the passenger cabin.

The on board fire extinguishers are normally small, and do not carry much extinguishing agent. It therefore, becomes more critical that proper operating technique to maximize the extinguishers usefulness. For this reason, we recommend all crew members should receive hands-on training with all types of extinguishers carried on board the aircraft once a year. This training should include a "hot drill", (actually putting out simulated cabin fires). Included in this training should be instruction concerning smoke and heat characteristics during a cabin fire, electrical fire hazards, and crash fire hazards.

We would also recommend that the FAA research the applicability of total flood extinguishing systems for air carrier aircraft. These systems use non-toxic (in the concentrations used) halonginated agents which suppress the fire. These type systems have already been approved for installation in business turbojet aircraft.

When a cabin fire has progressed to the point that the extinguishers are not effective, then prior efforts taken to improve passenger survivability prove most beneficial. There are many different items that must be addressed in the cabin to maximize and extend survival time. Reduction of smoke and toxic gases, emergency egress aids such as floor level emergency lighting, full face smoke masks with self-contained air supply for the flight crew, reduction of cabin flammability, and better passenger education are some of the items which in combination can prove to be the difference between a plane full of dead passengers or a successful evacuation.

The biggest problem with an aircraft cabin on fire is that there are so many petroleum based (plastics) combustibles on board the aircraft. A typical 300 seat transport has 2,400 pounds of potentially combustible materials in the seats alone. When these seats and the rest of the interior burn they produce dense clouds of smoke, toxic gases, and flames which ignite other cabin materials. The seats, interior panels, carpeting, insulation, and carry-on baggage all contribute to this fuel source. Many of the toxic gases produced can irritate the eyes which reduces, or eliminates, vision, restricts or eliminates the ability to breath due to acid formation, and can result in incapacitation and death.

The smoke which is generated as a result of the fire also eliminates visibility which creates panic, confusion, and difficulty in finding the exits. This can happen very early in the fire sequence.

When the fire produces the above mentioned gases and smoke, it also reduces the oxygen available to the passengers. As the cabin burns, heat builds in the cabin along with the smoke and toxic gases. When the temperature reaches the proper level, these gases will ignite throughout the cabin resulting in a cabin flashover, or gas explosion. The flashover occurs in a matter of seconds and increases the cabin temperature to above 1500°F. This is unsurvivable for any occupants still alive in the cabin.

The problems of cabin fire safety outlined above are complex and involved; however, the industry and the FAA have been aware of these problems for many years. The Air Line Pilots Association, United Airlines, and NASA in 1965 conducted tests at Cleveland Hopkins Airport to look at cabin survival during a fire. As a result of these tests, various toxic gases were identified as being by-products of the interior burning. The effect of these toxic gases on passenger survival was not known at that time. The results of these tests were given to the FAA, the Federal Air Surgeon, and aircraft manufacturers.

Since that time, the FAA, at the Civil Aeromedical Institute (CAMI), and the Federal Aviation Administration Technical Center have done a tremendous job in researching all the variables involved in a cabin fire and how to best increase the chances of survival for the passengers and crew. We would like to take this opportunity to complement the FAA on their recent announcement that they plan to issue a NPRM on seat blocking layers to prevent the seats from catching fire and burning so quickly; however, much remains to be done.

It is unfortunate that the FAA's findings have not been implemented, especially when it is recognized that a new generation of air carrier aircraft have been certificated under outdated regulations. It is the opinion of this Association that enough knowledge has been gained through the normal progression of technology and the extensive testing conducted by the FAA to require safer cabin interiors which are resistant to the problems referenced above. We must take exception to rationale contained in the recent statement made by the FAA, "that there has not been one case of a passenger dying due to an in-flight fire on a scheduled U.S. carrier aircraft since jet aircraft were first introduced more than 20 years ago". While the statement in itself is true, it ignores the experience of other countries who operate U.S. built aircraft certificated to FAR Part 25 standards.

On July 11, 1973 a Boeing 707 experienced a cabin fire on approach to Orly, France. The fire appeared to have started in the lavatory. One hundred twenty-three people died as a result of the fire. The medical report stated that all died due to smoke inhalation.

On August 19, 1980 a Saudi Arabian Airlines Lockheed 1011 caught fire in a cargo compartment which burnt into the passenger compartment. All 301 people on board the aircraft died. The cargo compartments of the L-1011 are designed so they do not support combustion, but in this case something went wrong.

These are two examples of situations where the prevention method did not prevent the fire from occurring. It is our opinion that incorporation of the following recommendations would substantially reduce the likelihood of these tragedies occurring again, here or abroad.

1. All air crew members should receive annual refresher training in aircraft escape procedures after their initial emergency procedures exposure. Such training should take place with the flight and cabin crew members working together, rather than training separately; this provides a realistic orientation to the emergency procedures drills and accurately simulates accident experience of the entire air crew directing cabin evacuation. Air crew members should be made aware of each other's required emergency duties.

2. All crew members should be provided with self-contained breathing apparatus (SCBA) in order to assist as much as possible in the emergency evacuation. This could be either a full-face mask with supplemental oxygen or a hood with supplemental oxygen.

3. The pilot oxygen mask/smoke goggle combination standards must be strengthened. Too many present combinations are ineffective when needed. The technology and test methods exist to do this.

4. In addition to emergency lighting now located in the ceiling, additional cabin emergency lighting should be installed at or below seat level to prevent its obscuration by dense smoke, and cabin exits should be brightly illuminated to permit rapid identification under emergency circumstances.

5. Lightweight trash compactors should be installed in galley areas to allow compact bundling of cabin service litter, since compacted solid waste is much more difficult to ignite. This would also eliminate the current accumulation of bulky trash bags in cabin escape areas.

6. All cabin interior furnishings should consist of fire-resistant materials that are self-extinguishing once ignited and that produce low quantities of toxic gases and smoke. Such criteria would aid and ensure a clear view of emergency routes and exits to aircraft occupants and minimize fatalities by gas or smoke inhalation.

7. Passenger carry-on baggage items should be restricted to those which

do not produce large amounts of toxic smoke or gases when subjected to cabin fires, and limited in quantity to reduce the restriction they present during emergency evacuations.

8. All seat trays should be located in the armrests, not in the seat backs, to prevent crash injury and not impede evacuation when seat back tray tables are dislodged.

9. Emergency exits shall be capable of being rapidly closed if inadvertently opened into a fire area.

10. Class D cargo compartments of over 500 cubic foot capacity have been found to support combustion long enough to enable the cargo wall to burn through, resulting in fire spreading to adjacent areas. Compartments of this size or larger should be equipped with both fire detection and extinguishing capacity. All cargo compartments, regardless of size, should be lined with additional insulating materials capable of containing the maximum degree of fire obtainable with the oxygen available in the compartment during in-flight conditions.

If all the recommendations referenced above were implemented passenger survival would still not be ensured in all situations, it would only ensure the passengers would survive longer in the worse case situation. When a fire occurs on board an air carrier aircraft, no matter if it occurs in-flight or post crash, escape from the airplane depends on numerous variables, one of which is the crashworthiness and survivability offered by the cabin interior. Another variable is the effectiveness of the crash/fire/rescue (CFR) services on the airport.

Air carrier airports are required to maintain a minimum level of safety by the FAA who issued FAR Part 139 (titled Certification and Operations: Land Airports Serving CAB-Certificated Air Carriers). Part of this regulation requires the airport to maintain a minimum level of CFR capability if air carriersuse their airport. This minimum level is determined based on aircraft size and total number of movements of aircraft at that airport per day. This CFR service often provides the last chance for the survival of the passengers of any aircraft on fire. The FAA is presently reviewing FAR Part 139 in preparation for the issuance of a NPRM on this regulation. We believe the level of fire protection presently required by the FAA in FAR Part 139 is the absolute minimum which is acceptable for safe operations. Any reduction of this protection will reduce the chance of survival for the passengers of an aircraft on fire. We would be opposed to any changes that would reduce the present level of CFR services.

For the Air Line Pilots Association's positions and recommendations on CFR, reference ALPA's Rescue and Fire Committee position papers, Positions #1, 2, and 3 (April 1981) and the Association's Analysis and Comments on the Cost/Benefit Analysis Study of CFR contracted by the FAA (May 25, 1983).

When the topic of air carrier accident survival is addressed, the discussion normally centers on the survivable accident that occurs on the airport with fire involvement. Another survivable accident scenario which is not often discussed, but is as much a threat to passenger survival is the unplanned water landing. In this type of accident, it is entirely possible to have all the passengers and crew survive the impact and escape from the cabin only to die in the water due to hypothermina and drowning. The present FAA regulations and waiver practices have resulted in a situation where survival equipment has not kept pace with technology and many aircraft are operating up to 160 miles off shore without liferafts.

The Air Line Pilots Association does not agree with the FAA's philosophy that since no U.S. air carrier aircraft has ever experienced an inadvertent water contact survivable accident with subsequent loss of life due to drowning and hypothermia, no problem exists. In December 1980, ALPA petitioned the FAA to amend various sections of FAR Parts 1, 25, 121 and 139 of the Federal Aviation Regulations (FAR) to improve the survivability of aircraft in accidents resulting from intentional or unintentional water contact. (Regulatory Docket No. 21222, November 30, 1982) In December of 1982, two years later, the FAA issued a Denial of Petition. The FAA based their denial on the fact that they are researching this issue and to make any judgements prior to the completion of their research would be premature.

Areas of concern germane to passenger survival contained in ALPA's petition included the use of outdated life vest designs which are difficult to don, poor life vest location, the use of flotation cushions as the sole flotation device, and the development and requirement to use flotation platforms which would keep survivors out of the water to prevent hypothermia.

The Civil Aeromedical Institute (CAMI) of the FAA is in the process of researching all of the above concerns. The researchers at CAMI are capable and thorough; their findings will, as much as possible, reflect the true nature of the overwater survival concerns. This Association plans to very closely monitor the progress made by the FAA on this issue to ensure that after their research is completed, rulemaking is initiated.

As can be seen by our statement, there are many apparently unrelated variables which influence accident survival and cabin safety. This Association has been on record for many years requesting improved safety standards in all these separate areas. Our concern has always been the maximum safety for our passengers and crews. The reason why many of the safety improvements made possible by the FAA and industries research, and the advancement of technology not being implemented remains a mystery to us. The research is done, the findings are forwarded to FAA management at 800 Independence Avenue in Washington, D.C. and no NPRM results. If cabin safety and accident survival are to be legitimate concerns of the FAA, they must respond to the increasing knowledge and technology advances before an accident occurs, not implement safety measures after an accident.

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

SPECIAL STUDY

CABIN SAFETY IN LARGE TRANSPORT AIRCRAFT

NTSB-AAS-81-2

UNITED STATES GOVERNMENT

RS-NTSOO-013

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. NTSB-AAS-81-2	2. Government Accession No. PB82-129297	3. Recipient's Catalog No.
4. Title and Subtitle Special Study—Cabin Safety In Large Transport Aircraft		5. Report Date September 9, 1981 6. Performing Organization Code
7. Author(s)		8. Performing Organization Report No.
9. Performing Organization Name and Address National Transportation Safety Board Bureau of Technology Washington, D.C. 20594		10. Work Unit No. 3180A 11. Contract or Grant No.
12. Sponsoring Agency Name and Address NATIONAL TRANSPORTATION SAFETY BOARD Washington, D. C. 20594		13. Type of Report and Period Covered Special Study 14. Sponsoring Agency Code

15. Supplementary Notes
The subject report was distributed to NTSB mailing lists: 1A, 8A and 8B.

16. Abstract

A study by the National Transportation Safety Board showed that in 58.4 percent of the 77 survivable/partially survivable passenger carrying transport aircraft accidents/incidents occurring since 1970, there were failures of cabin furnishings. These failures killed, injured, entrapped or otherwise incapacitated aircraft occupants preventing successful emergency escape in many cases. Failures of cabin furnishings also created obstacles to egress by blocking aisles and exits.

Regulations dealing with occupant protection in crashes were last updated 30 years ago. They do not adequately reflect actual crash experience nor do they provide adequate protection to occupants in survivable crashes, especially the more severe crashes, where it is most needed.

Recent accident experience supports the need to upgrade the current minimum design standards. Moreover, the technology exists for upgrading existing design and testing methods for cabin furnishings to meet the upgraded regulations.

17. Key Words Transport aircraft accidents; crashworthiness; seats/restraints; cabin furnishings; cabin safety; seat failures; static testing; dynamic testing.		18. Distribution Statement This document is available to the public through the National Technical Information Service-Springfield, Virginia 22161 *(Always refer to number listed in item 2)*	
19. Security Classification (of this report) UNCLASSIFIED	20. Security Classification (of this page) UNCLASSIFIED	21. No. of Pages 53	22. Price

NTSB Form 1765.2 (Rev. 9/74)

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D. C. 20594

SPECIAL STUDY

Adopted: September 9, 1981

CABIN SAFETY IN LARGE TRANSPORT AIRCRAFT

INTRODUCTION

On September 23, 1962, a Lockheed Constellation ditched in the North Atlantic with 76 persons on board. Most of the survivors believed that the deceleration of the aircraft was not extreme. However, many seat units failed at impact, creating egress difficulties for passengers who first had to free themselves from the pile of seats. The Bureau of Aviation Safety of the Civil Aeronautics Board (CAB) (the predecessor agency of the National Transportation Safety Board) concluded that these seat failures probably prevented at least some of the 28 persons who did not survive the accident from evacuating the aircraft. As a result, the CAB recommended to the Federal Aviation Agency (the predecessor agency of the Federal Aviation Administration) (FAA):

> . . . We are convinced from this accident and others in recent years that an increase in the minimum level (of crashworthiness) is long overdue. Accordingly, it is recommended that the studies relative to crash load factors and dynamic seat testing criteria which we understand are now under way in your agency be expedited toward the end of achieving improved safety in this area at the earliest date.

In response to this recommendation, the FAA stated:

> We concur with the views contained in (your) recommendation relative to adequacy of seat tie-down. We wish to assure you that the need for necessary studies relative to crash load factors and dynamic seat testing criteria is clearly recognized and that these studies are being expedited by our Aircraft Development Service consistent with available manpower and funds.

In 1962, the regulations regarding crash forces were already about 10 years old; today, 30 years after the standard was established and almost 20 years after the first recommendation, these regulations have yet to be changed, and seats and other cabin furnishings continue to fail in aircraft accidents regardless of the severity of impact.

Since 1970, almost 60 percent of the large transport aircraft involved in survivable and partially survivable major accidents and incidents investigated by the Safety Board have exhibited failures of cabin furnishings. Of the more than 4,800 passengers and crew involved in these accidents, over 1,850 were injured or killed. The Safety Board believes that many of these injuries and deaths would have been prevented had cabin furnishings not failed, particularly in accidents involving fire (about 46 percent).

The Safety Board conducted this special study to determine whether the failure of cabin furnishings is an ongoing problem and whether regulations dealing with these areas are adequate.

The Safety Board s[illegible] certain criteria for choosing the cases used in this study. Specific detailed information about failures of cabin furnishings was found most consistently in reports by the Safety Board of major investigations and by its field investigations in which Washington headquarters technical specialists had participated. For the period 1970 through 1980, this included about 234 accidents and incidents.

To reflect realistically today's air carrier fleet, the study was limited to turbojet and turboprop powered aircraft capable of carrying 30 or more passengers, and type-certificated under Civil Air Regulations (CAR) Part 4b -- Airplane Airworthiness Transport Categories, or Federal Aviation Regulations (FAR) Part 25 -- Airworthiness Standards: Transport Category Airplanes. Of the 234 cases, 108, or 46 percent, met these criteria. Since the study deals with cabin safety, accidents and incidents involving nonpassenger carrying flights such as cargo, ferry, and crew training flights were eliminated, reducing the study group to 88 cases.

The study was limited further to those accidents in which the crashes were survivable or partially survivable. 1/ The definition of a survivable accident as used by the Safety Board was developed from crash injury research done by Aviation Crash Injury Research (AvCIR) of Cornell University and Aviation Safety Engineering and Research (AvSER) of the Flight Safety Foundation. The definition was used in the Aircraft Crash Survival Design Guide 2/ which was prepared for the U.S. Army Research and Technology Laboratories, in conjunction with other Government agencies. The definition follows:

> Survivable Accident: An accident in which the forces transmitted to the occupant through his seat and restraint system do not exceed the limits of human tolerance to abrupt accelerations and in which the structure in the occupant's immediate environment remains substantially intact to the extent that a livable volume is provided for the occupants throughout the crash sequence.

Although this definition is subjective and open to some degree of interpretation, the Safety Board has found it can be used by trained investigators to assess survivability accurately.

Although the precise g-levels beyond which human tolerance is exceeded is not universally agreed upon, in the late 1960's, the Safety Board, FAA-CAMI, and others in and out of Government concluded, based on studies, experiments, and accident investigation into injury causation done over two decades, that, under certain conditions, the human body can withstand forces two to three times greater than those cited in 14 CFR 25.561 (9.0g forward, 4.5g downward, 1.5g sideward, and 2.0g upward), without irreversible injury. The conditions are--that the occupant is restrained by lap belt and that the aircraft and occupants experience a rate of onset and duration of forces typical of those experienced in survivable crashes. These force parameters were determined through investigation, research, and experimentation which culminated in the full scale crash tests of aircraft. The ranges of these forces are: 3/

1/ The term survivable, without further qualification, will be used hereafter to encompass both categories of accidents.

2/ Aircraft Crash Survival Design Guide, USARTL-TR-79-22, Applied Technology Laboratory, U.S. Army Research and Technology Laboratories (AVRADCOM), Fort Eustis, Virginia, 1980.

3/ For comparison, in the forward direction, the Air Force design recommendation is 45g for 0.1 second, based on seatbelt and upper torso restraint. Findings from human free-falls and corroborating findings from animal tests indicate that tolerance in the forward direction may be as high as 237g (for 0.35 seconds at 11,250g/sec) with optimum full-body restraint.

Direction	g's
Forward	20-25
Downward	15-20
Sideward	10-15
Upward	20
Duration from 0.1 to 0.2 seconds	
Rate of onset 50g/second	

Many of these tests have also shown that the limits in the forward direction can be doubled by the use of an upper torso restraint (shoulder harness). 4/

Investigations have shown, however, that even when crash forces fall within the survivable range, few if any survive the accident because of postcrash fire or emergency evacuation problems. Crashes have been found to be nonsurvivable for certain occupants when the forces transmitted to occupants were within human tolerance to abrupt acceleration, but the seat/restraint system failed, allowing the occupant to become a missle traveling at essentially the same velocity as the aircraft just before impact. The occupant, free to strike other objects in the aircraft, died or was incapacitated, and thereby could not effect a successful emergency evacuation. Crashes were also found to be "partially survivable" when the aircraft itself struck an object that destroyed the integrity of the hull or caused forces to be transmitted to the occupant which surpassed the human tolerance limits in a localized area. While the crash forces in this portion of the aircraft were nonsurvivable, those in other areas of the aircraft were within the survival envelope.

After applying the definition above and taking into account the limitations of the definition, 11 of the 88 cases were found to be nonsurvivable, leaving 77 for further study.

ACCIDENT DATA

Location/Phase of Operation

Data developed from evaluation of 77 survivable cases showed that airport proximity and crash survivability are related. (See table 1 and appendix table 1.) About 58 percent of the survivable accidents and incidents occurred on the airport, while about 26 percent occurred more than 5 miles away. Almost 55 percent of nonsurvivable accidents occurred more than 5 miles from the airport and only about 36 percent occurred on the airport. Those survivable/partially survivable accidents occurring on the airport made up the largest single group in this study.

Table 1.--Transport Aircraft Accidents by Airport Proximity.

	On	1-5 miles	Greater than 5 miles	Total
Survivable/Partially-Survivable	45	12	20	77
Percent	58.44	15.58	25.97	
Nonsurvivable	4	1	6	11
Percent	36.36	9.09	54.55	

4/ A compilation of data on human tolerance to abrupt acceleration can be found in Snyder, R.G., Advanced Techniques in Crash Impact Protection and Emergency Egress from Air Transport Aircraft, AGARD-AG-221, June 1976.

The majority of these accidents/incidents occurred during the takeoff, approach, and landing phases of operation. (See appendix A for definitions of phases of operation.) About 75 percent of these survivable cases fall into those three categories.

The accident types cited most often include collision with ground/water, engine failure or malfunction, and collision with obstacle. (See table 2.) These accident types comprise about 38 percent of the survivable cases. The landing-type accidents which include gear retracted, hard landing, overshoot and undershoot, were cited in about 22 percent of these cases. In-flight accident types such as turbulence, evasive maneuver, and uncontrolled altitude deviation accounted for 14 percent.

Cases in Which Failures Occurred

In 45, or 58.4 percent, of the 77 survivable cases, there was evidence of failures of seat/restraint systems or other furnishings in the aircraft cabin. These 45 cases include accidents/incidents in flight as well as those on the ground. (See appendix table 2 for more detailed information.)

Table 2.--Transport Aircraft Accidents by Phase of Operation.

Accident Type	Static	Taxi	Takeoff	Climb	Cruise	Descent	Approach	Landing	Total
Ground-water loop-swerve		1							1
Gear retracted								1	1
Hard landing								3	3
Overshoot								7	7
Undershoot							2	4	6
Collision with aircraft		2	1			1	2	1	7
Collision with ground/water			2				7	1	10
Collision with obstacle			5				4		9
Stall/mush			1	1			1		3
Fire or explosion in-flight			1						1
Airframe failure			3	3	1				7
Engine failure or malfunction			5		2		1	2	10
Prop/rotor failure							1		1
Turbulence				1	3		1		5
Evasive maneuver			1		2	1	1		5
Uncontrolled altitude deviation					1				1
Miscellaneous	1					1			2
Totals	1	3	19	5	9	3	20	19	79 1/

1/ Total includes two cases involving a collision between two transport aircraft.

In 29, or 64.4 percent, of these cases, the accident/incident occurred on the airport. Consistent with the larger samples, about 82 percent of the 45 accidents/incidents occurred during the takeoff, approach, and landing phases of operation. (See table 3.)

Table 3.--Transport Aircraft Accidents by Airport Proximity and Phase of Operation.

Phase of Operation	On	1-5 miles	Greater than 5 miles	Total
Taxi	2			2
Takeoff	10	1		11
Climb			2	2
Cruise			4	4
Descent			1	1
Approach	4	5	2	11
Landing	14		1	15
Total	30 1/	6	10	46 1/

1/ Includes one case involving a collision between two transport aircraft.

In 10 of the 29 accidents which occurred on airports, no obstacles were struck. In most of the remaining 19 cases, more than 1 type of obstacle was usually involved in a given accident. As shown in the tabulation below, the most commonly involved obstacles were lights and their supporting stanchions, fences, dikes and embankments, and ditches.

Obstacle	No. of times involved
Lights/stanchions	10
Fences	6
Hills/mounds	2
Navigation facilities	2
Embankment/dike	7
Ditch	6
Roadways/concrete walkways or foundations	1
Boulders/rocks	3
Trees/stumps	4
Aircraft	2
Buildings	1
Autos	2

Providing a typical description of a group of accidents is difficult because of the complexities and interactions of the individual events of each. However, these 29 accidents suggest that the following major events typically occur during on-airport accidents. The average aircraft speeds are about 130 knots or below since most accidents occur during the takeoff or landing phases. The first event is the collapse or tearaway of one or more landing gears caused either by striking objects or by hard landings. Usually, the fuselage structure is damaged, mainly by crushing and tearing of the underside of the fuselage often accompanied by localized displacement or breaks in the cabin floor structure.

Usually the wings are damaged; much of this damage is minor, consisting of some crushing and abrading of the leading and trailing edges and tearing or puncturing of the skin. Occasionally, wing-mounted engines are torn away, and in some cases, major portions of the wing structure are separated from the fuselage. Whenever the wing structure is opened and fuel escapes, the potential for fire exists. Fire erupted in 21, or 46.7 percent, of the 45 accidents in which cabin furnishings failed. Fires erupted in 56.7 percent of the 29 accidents that occurred on the airport. (See appendix table 2.)

Finally, in just over half of the on-airport accidents, circumferential breaks or buckles will occur in the fuselage, almost always just aft of the cockpit or just forward of the empennage. These areas are the most vulnerable portions of the structure to bending and torsional loading during crashes.

Many factors, such as aircraft velocity and attitude at impact, affect the loads on an aircraft and ultimately its passengers. Different types of terrain, such as a paved surface, hard-packed earth, mud, sand, or dense vegetation, will make a difference in the rate at which the aircraft's velocity is reduced. Large changes in velocity over extremely short periods of time can result from the movement of the aircraft through terrain types which differ greatly. These abrupt accelerations also occur when various obstacles are struck, resulting in forces which may be spread throughout the structure or focused in highly localized areas of the aircraft. These forces can and do act in all directions and probably will never act in one direction only. The exact forces being transmitted through the aircraft structure to the aircraft cabin and its occupants during a crash are continually changing and are essentially impossible to predict accurately for all cases. Many times, the forces, and therefore the severity of these accidents, are increased needlessly by collisions with various obstacles in the airport environment.

Since it is impossible to completely control the crash environment in off-airport accidents, it becomes even more important to design the aircraft and its components so that the occupants are adequately protected in survivable crashes. The following tabulation was compiled from data contained in Appendix Table 2. It shows the types of obstacles encountered by aircraft in survivable off-airport accidents/incidents where failures occurred. Six of the 16 cases occurred in flight and no obstacles were involved. Three additional accidents involved collisions with water where no other objects were struck. The seven remaining off-airport cases typically involved collisions with more than one of the following obstacles.

Obstacle	No. of times involved
Trees/Poles	8
House/Building	5
Power Lines	1
Autos	1
Crops	1

Trees/poles are most often involved in the off-airport accidents. Impacts with these objects tend to cause crash forces to be focused in highly localized areas and to destroy large portions of the fuselage skin. This destruction allows much of the crash energy to be absorbed, but results in accidents which are only partially survivable. In these cases, it is critical that occupants be retained in their seats and that the seats remain attached to the floor structure throughout the crash sequence, i.e., the integrity of the tiedown chain (seat, restraints, seat attachments, and floor) must be maintained.

Cabin Furnishings

Seat/Restraint System.--Components of the seat/restraint systems failed in 84.4 percent of the accidents/incidents examined. (See appendix table 2.) Most of the failures typically occurred in the seat legs and seat-to-track attach points. In many cases, the cabin floor was deformed by localized impacts or bending and buckling of the fuselage, causing seat tracks to break and separate and allowing the partially unrestrained seat to rotate laterally. The uncontrolled movement of the seat placed additional stresses on the remaining seat attach points, seat legs, or floor tracks, resulting in additional failures. (See figures 1 and 2.) Additionally, seat backs, seat pans, frames, arm rests, and tray tables failed. Some component of the restraint system failed in about 22 percent of the cases. Most of these were failures of the belt attachment hardware rather than failures of the belt webbing material.

Overhead Furnishings.--Overhead panels, racks, and passenger-service units failed in 77.8 percent of the cases examined. (See appendix table 2.) Failures of overhead furnishings were placed into two categories--failures that caused injury and those that hampered emergency egress.

Head injuries most often resulted from failures of overhead furnishings. While these injuries may not be serious, a person could lose consciousness temporarily or could be stunned, resulting in confusion and inability to identify and react to an emergency situation. As a result, valuable evacuation time may be lost, especially when fire or the potential for fire is present.

In the cases examined, the basic designs or failures of overhead racks or bins allowed items stored there to become missiles during the crash sequence; these items inflict injuries, in some cases incapacitating ones. Emergency evacuation was also hampered when items stored in overhead compartments were released. Even items, such as blankets, pillows, and coats, which are unlikely to cause injury when they become loose, were thrown into the aisles and against bulkheads adjacent to the exits, creating barriers to exits.

Failed overhead racks or bins also blocked movement in the cabin by cutting off access to and from aisles and overwing exits. (See figure 3.) Figure 4 shows hazards created by failed passenger service units.

Galley Equipment.--Components of galley equipment failed in about 62 percent of the accidents/incidents examined. In almost all cases, food, eating utensils, and waste material were thrown from open storage areas or from containers and drawers that did not remain latched. Often, the drawers and their inserts were released. Since the galleys were usually located near exits, the materials released from them blocked egress. Failures of individual galley components or displacement of entire galley units have blocked exit doors so that they could only be opened partially or not at all.

Flight attendants, whose main duty is to provide direction and assistance to passengers in emergencies, were seated at their designated positions at the exits where the galleys were located. In several instances, hot liquids from containers splashed onto the flight attendants. Although these injuries were minor, the potential for serious injury was present. The potential is also great for injury to flight attendants when galley drawers come open and the flight attendants, whether restrained or not, come into contact with the sharp edges of these opened drawers or with objects released from them. Although these injuries may be minor, they can seriously compromise the flight attendants' ability to assist passengers during emergencies.

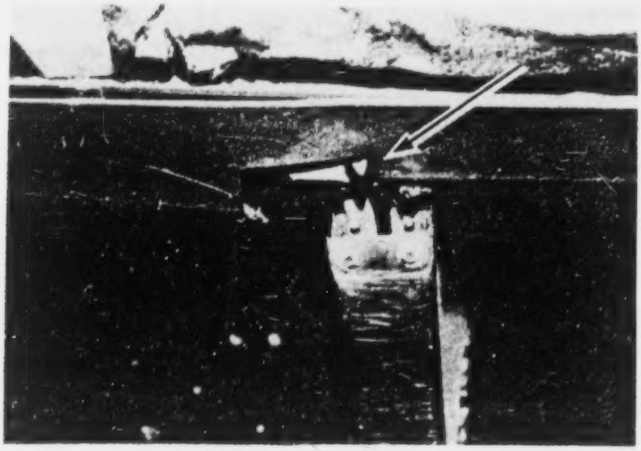


Figure 1.--Failure at seat frame to seat leg attach point during overrun accident.

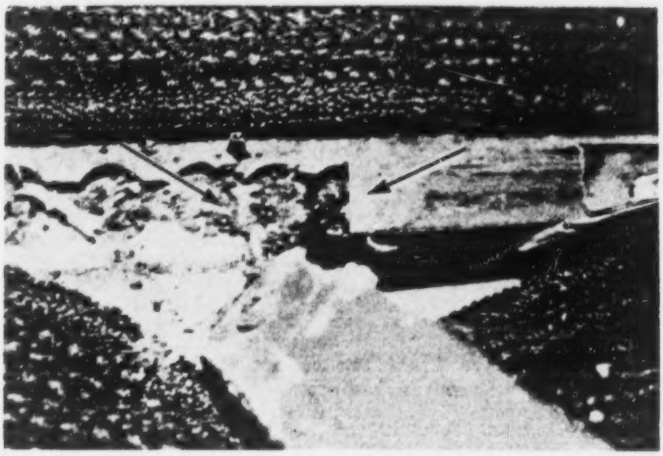


Figure 2.--Failure of floor track at attach point with separation of leg from horizontal bar during overrun accident.

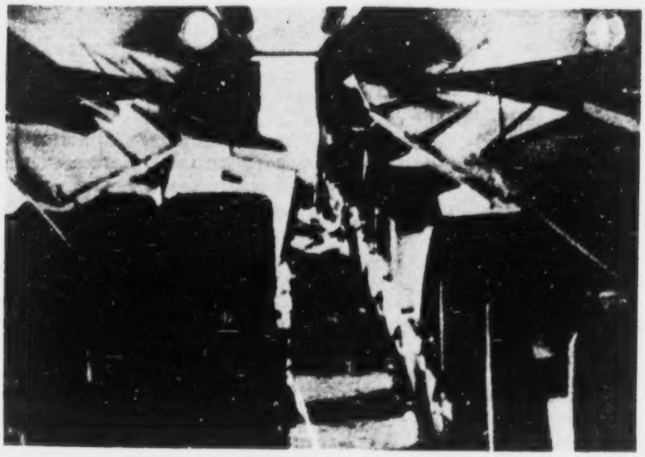


Figure 3.--Typical collapsed overhead racks.

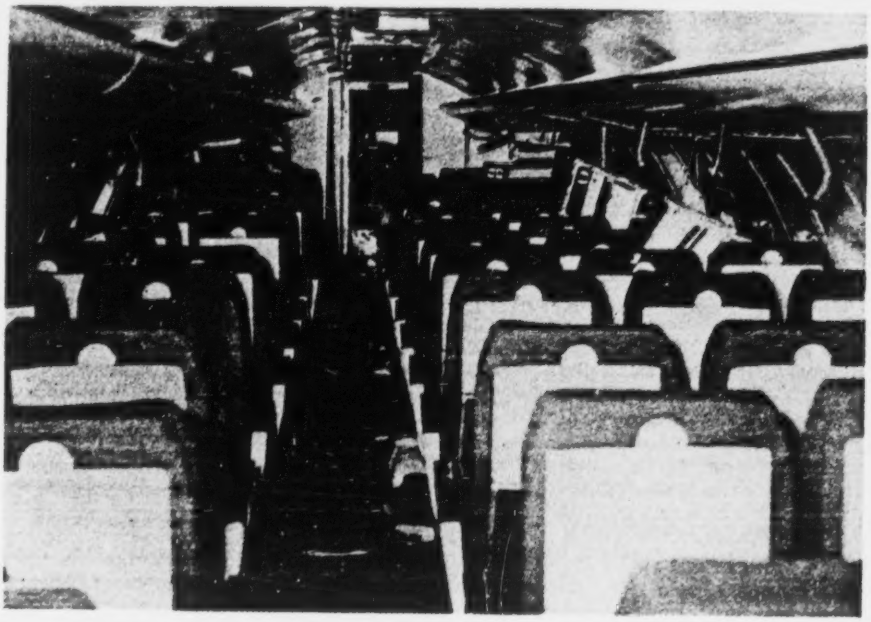


Figure 4.--View toward the forward portion of the aircraft.
(Note the passenger service units
hanging over the A and E seats in each row.)

CASE HISTORIES

Case 1

On June 23, 1976, Allegheny Airlines Flight 121, a DC-9, N994VJ, crashed while attempting a go-around during an approach to runway 27R at Philadelphia International Airport. 5/ The aircraft contacted the ground at a point about 6,000 feet down and slightly to the right of the runway. After sliding about 2,000 feet, it came to rest on the grass-covered infield, perpendicular to the runway. The terrain was level and there were no obstacles. The tail of the aircraft, with engines mounted, separated from the fuselage and was found about 400 feet back along the crash path. There was no postcrash fire. (See figure 5.)

The bottom of the fuselage was damaged severely. The skin was torn and abraded, frames were crushed, stringers were damaged along the entire length of the fuselage, and the floor above the landing gears was buckled upward. The wings remained intact and connected to the fuselage; there were no fuel leaks from the wing tanks. (See figure 6.)

Inside the cabin, galley equipment, magazine racks, overhead racks, and light panels failed, and baggage and garments were thrown into the aisle. The cabin floor was buckled and displaced upward as much as 12 inches in some sections. About 95 seats, including 3 crew seats, failed at impact. The passenger seats had been rated to withstand 7.5g in the downward direction and 4.5g in the upward direction; the required minimums are 4.5g downward and 2.0g upward. The crew seats had been tested to 8.63g downward. At the Safety Board's request, the Douglas Aircraft Company performed a failure mode analysis on the failed flight attendant seat and found that forces experienced in the forward fuselage as a result of impact were at least 10g in the downward direction.

No one among the 107 persons on board the aircraft was killed; however, 36 persons were injured seriously, the majority of which suffered spinal fractures. Other injuries included fractures to extremeties, back sprains and strains, whiplash, contusions, lacerations and abrasions to the head, face, and extremities, and broken teeth. Only 20 passengers reported no injuries.

Passenger and crew statements included the following observations. The seat failures occurred at impact and caused passengers to be thrown into adjacent seats, or pinned them between seats, between the floor and seats, and between seats and side walls. Failed seats were thrown into the aisle and against other seats, hampering the flow of passengers to the exits. As many as 12 passengers were immobilized by injuries or trapped by failed seats and were still in the aircraft when firemen arrived. In addition, overhead storage racks spilled their contents into the aisles. Some passengers encountered baggage and garments in the aisle during evacuation, and some stopped to retrieve possessions before leaving the aircraft. One flight attendant, whose seat failed incapacitating her with a spinal fracture, recalled seeing two coffee pots and liquid on the floor. (See figures 7 and 8.)

With regard to survivability in this accident, the Safety Board has drawn the following conclusions:

- o The g-levels were well in excess of those cited in the regulations, yet the accident clearly was survivable. Force levels were within the range of human tolerance since there were no fatalities.

5/ Aircraft Accident Report: Allegheny Airlines, Inc., Douglas DC-9, N994VJ, Philadelphia, Pennsylvania, June 23, 1976, (NTSB-AAR-78-2).

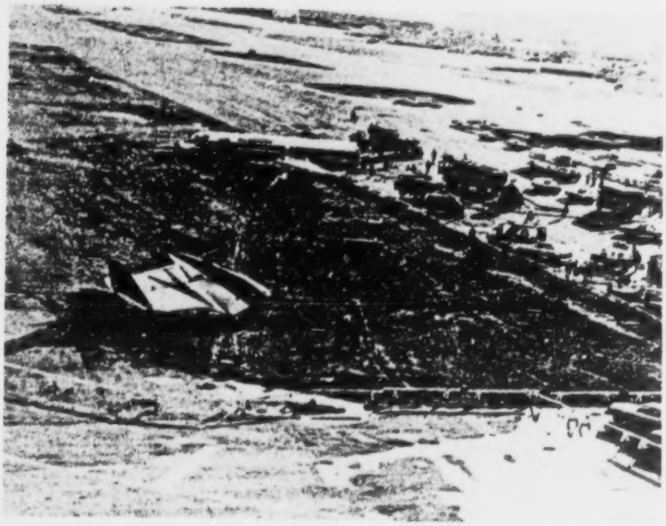


Figure 5.--View of crash site.
(Note aircraft tail and engines in foreground and to far left.)

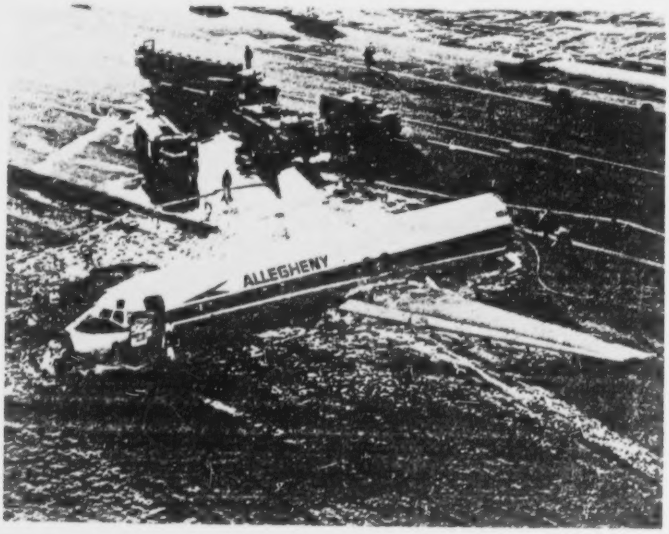


Figure 6.--View of fuselage exterior.

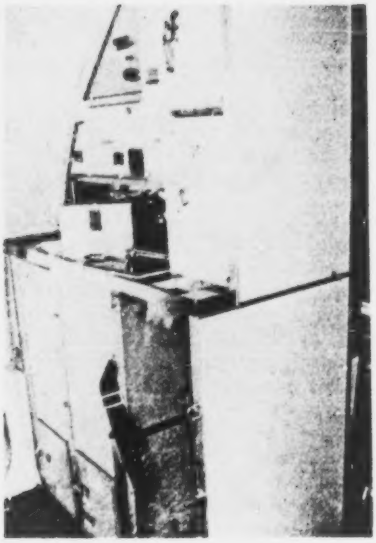


Figure 7.--No. 2 galley.
(Note flight attendant's keys and failed trash
trolley restraint strap fastener.)

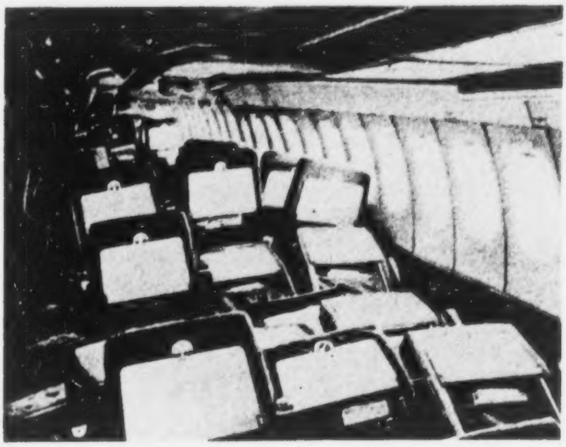


Figure 8.--View of passenger seats forward from row 20.

- Injuries were caused by failed seat systems and other cabin furnishings.
- Had the seat systems and cabin furnishings been designed and built to withstand the higher loads, few if any injuries would have occurred.
- Had fire erupted, at least 12 persons would have died because of incapacitation, entrapment, or hampered egress, caused by preventable failures of cabin furnishings.

Case 2

On November 12, 1975, an Overseas National Airways DC-10, N1032F, was attempting to take off from runway 13R at John F. Kennedy International Airport, Jamaica, New York. 6/ During the takeoff roll, several sea gulls were ingested into the No. 3 engine and the takeoff was rejected. During deceleration, the No. 3 engine disintegrated and caught fire. The aircraft did not decelerate as expected, and as it continued to roll, several tires and wheels disintegrated. As the aircraft approached the end of the runway, the captain turned the aircraft left onto a taxiway, and as it rolled to a stop, the right landing gear collapsed. The aircraft was consumed by fire which erupted on the right wing.

Since the aircraft was destroyed by fire, passenger and crew statements were used to reconstruct events inside the aircraft cabin. This flight was unique in that the 128 passengers were all employees of the carrier, including 20 flightcrew members and 93 flight attendants. All but one passenger had received varying degrees of emergency training or familiarization on the aircraft.

Although no seats failed, passengers reported that several ceiling panels were dislodged, one of which partially blocked the aisle on the left side of the cabin and exit 4L. Several oxygen mask access doors (located in the seatbacks) in the forward cabin opened during the stopping roll. Also, a movie projector at row 17 came down on its platform over the heads of seated passengers. Carry-on baggage, pillows, and blankets were thrown into the aisles, hampering passenger access to the 1R and 4L exits.

There were no fatalities, only 2 serious injuries, and 30 minor injuries--many as a result of problems encountered in using escape ropes and slides. Passengers attributed some injuries to contact with items in the cabin, such as seats, arm rests, and carry-on baggage. The aircraft was evacuated in less than 1 minute. Passengers were surprised at the speed at which fire consumed the aircraft and the short time available to evacuate. Both the crew and passengers indicated that evacuating a full load of 380 passengers would have been impossible.

With regard to survivability in this accident, the Safety Board has drawn the following conclusions:

- The force levels were well below those cited in the regulations.
- Even though the force levels were low, cabin furnishings failed, causing injuries, blocking exits, and hampering egress--all of which could have contributed to deaths by fire had this aircraft been fully loaded.

6/ Aircraft Accident Report: Overseas National Airways, Inc., Douglas DC-10-30, N1032F, John F. Kennedy International Airport, Jamaica, New York, November 12, 1975, (NTSB-AAR-76-19).

- This aircraft was properly certificated by the FAA; therefore, it must have successfully met all requirements. However, since failures occurred at levels below those specified in the regulations, it is likely that the methods used in certification were inadequate.

Case 3

On February 17, 1981, an Air California B-737 crashed at John Wayne Airport, Santa Ana, California. [7] The aircraft was attempting to land on runway 19R, when it was told by the controller to go-around for another landing. The captain delayed compliance with the go-around instruction for about 12 seconds, then applied go-around thrust. The rate of descent, which was estimated to be less than 500 feet per minute, [8] was being arrested. However, before the aircraft could begin to climb, the landing gear was improperly selected up, and the aircraft contacted the runway. The first contact was made on the landing gear. As the aircraft continued down the runway, the landing gear continued to retract. When the aircraft came to rest off the right side of the runway, both main gear and the nose gear were found in the retracted position. (See figure 9.)

A summary of passenger statements indicates that most passengers described the aircraft as touching down, lifting off, and touching down hard. This was followed by the sensation of the aircraft's sliding hard, and passengers were thrown to the left. Some passengers reported that ceiling panels fell on them and many seats failed and became detached. Four persons were injured seriously, and 29 persons were injured slightly as a result of these failures. Passengers also became entrapped by broken seats.

Documentation of the seat failures throughout the cabin indicated forces acting downward and to the left, confirming statements by the passengers. Failures occurred mainly in the seat legs; others occurred in arm rests, seat-to-floor attachments, and the seat tracks. (See figures 10 and 11.)

The flight data recorder (FDR) used in the aircraft records vertical accelerations in g's. The vertical sensor in the recorder is not designed to record crash forces, and the reading is not extremely reliable on the ground; the forces recorded on the readout are in excess of those actually experienced because of the peculiarities of this recording instrument. However, the forces recorded undoubtedly represent the maximum forces acting on the airframe below the floor at the aircraft's center of gravity. The readout of the FDR shows that the range of forces was ±1.5 peak g's, indicating that the vertical forces acting on the airframe were within this range and probably considerably less. These vertical forces were well below the levels of human tolerance and well below the minimum standards set forth in 14 CFR 25.561. Even if these forces were magnified through the remaining structure to the occupant, it is unlikely that they would have surpassed the force levels cited in the regulations.

With regard to survivability in this accident, the Safety Board has drawn the following conclusions:

- The force levels in this accident were well below those cited in 14 CFR 25.561.
- Seat systems failed under combined loading downward and to the left; an event which can be detected using dynamic testing methods.
- The 4 serious and 29 minor injuries were caused by failure of seat systems and other cabin furnishings.

---

[7] Aircraft Accident Report: Air California Flight 336, B-737-293, N468AC, John Wayne Orange County Airport, Santa Ana, California, February 17, 1981, (NTSB-AAR-81-12).

[8] Rate of descent before touchdown was estimated from the altitude and time traces, two of the parameters recorded by the aircraft flight data recorder.

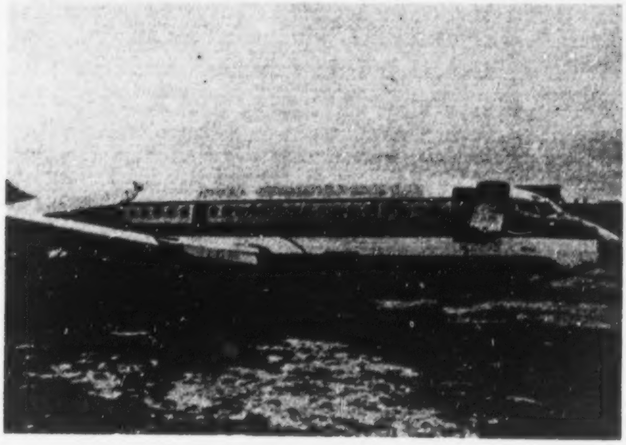


Figure 9.--Right side exterior.

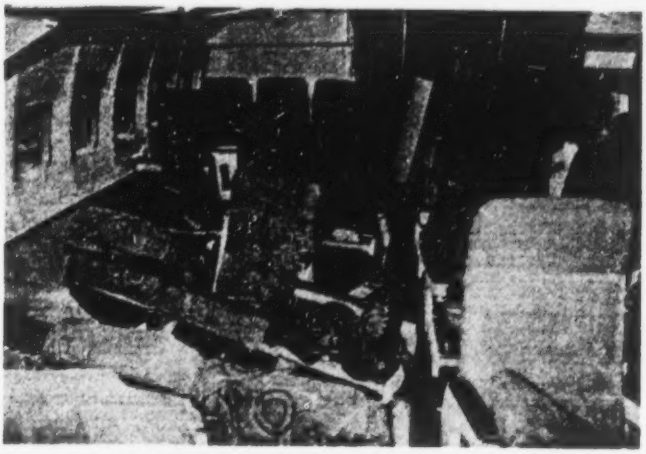


Figure 10.--Interior view to aft of cabin.

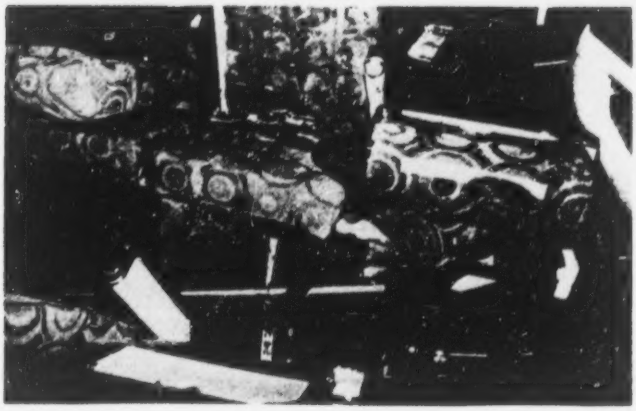


Figure 11.--Right side seat failure, down and to the left. (Note jagged end of broken seat leg.)

Case 4

On December 8, 1972, United Airlines Flight 553, a Boeing 737, N9031U, en route from Washington National Airport, Washington, D.C. to Chicago-Midway Airport, Chicago, Illinois, crashed in a residential area while attempting to execute a localizer-only instrument landing system (ILS) approach to runway 31L at Midway Airport. 9/ The aircraft collided with houses, garages, trees, and power poles, and fire erupted after impact.

The aircraft came to rest with its center section entangled with portions of collapsed houses. The right side of the aircraft fuselage was destroyed from the nose to row 5 in the first-class section; the left side remained intact. The fuselage broke in two places, forward of row 6, and between rows 9 and 10--both on the right side.

Most survivors described the decelerative forces as strong enough to throw them forward against the seatbelts and badly bruise and/or cut the lower abdomen and hips. Survivors reported that debris cluttered the aisle and exit routes, making movement within the cabin difficult. Included in the debris were overhead bins, ceiling panels, luggage, seats from the left side of the coach cabin, and liquor compartment and oven units from the aft galley.

One coach flight attendant stated:

> The evacuation was hampered because the overhead bins and seats on the left hand side had collapsed blocking the aisle. The passengers who were not pinned escaped by climbing over the partially collapsed seats on the right hand side. The plane was rapidly filling with smoke and I had to run to the door . . . for air before going back in to assist the cabin. I kept shouting for passengers to get out the back of the plane and was trying to release passenger in 16B whose leg was tangled in the wreckage.

9/ Aircraft Accident Report: United Air Lines, Inc., B-737, N9031U, Chicago-Midway Airport, Chicago, Illinois, December 8, 1972, (NTSB-AAR-73-16).

Another coach flight attendant stated:

> I went to the buffet door and I had a great deal of difficulty opening this door because the amount of debris on the floor seemed to be blocking not necessarily my getting to the door, but getting the door opened . . . . I ran back into the cabin, as far back as I could get into the cabin. The seats had become dislodged in the area that I could see and the ceiling had collapsed. . . . you could not see anything on the right hand side of the aircraft. The left hand side was just a jumble of seats.

To the extent that seat locations of survivors before impact could be established, no distinct survivability pattern emerged. Of the 61 persons on board, 43 were killed. Of these, 27 died of fire-related causes. About 27 percent of the first-class passengers, and 76 percent of the coach passengers died from fire or smoke and toxic fumes.

With regard to survivability in this accident, the Safety Board has drawn the following conclusions:

o The g-levels experienced by occupants in this crash were relatively high, but still well within the limits of human tolerance for most of the locations in the cabin.

o The number of fire-related deaths, which were likely the result of incapacitation or entrapment, probably could have been reduced significantly had seat systems and other furnishings been designed and tested to upgraded standards.

Case 5

On March 3, 1972, Mohawk Airlines Flight 405, an FH-227B, N7818M, en route from La Guardia Airport, New York, to Albany, New York, crashed while attempting to execute a localizer backcourse ILS approach to runway 01 at the Albany County Airport. 10/ The aircraft hit a house about 4 miles from the airport and came to rest within the confines of the residence. There was no fire. (See figure 12.)

The aircraft penetrated the right front of the house and stopped with the nose protruding about 25 feet from the back of the house and with the fuselage resting in the basement area. The nose of the aircraft was crushed back to the windshield, causing the instrument panel to be displaced to the front edge of the flightcrew's seats. The bottom of the fuselage was demolished and the cabin floor was split longitudinally for almost the full length of the fuselage. Each side of the floor where the seat tracks were attached was displaced upward. The occupiable cabin space was compromised to the extent that there was a severe elliptical deformation in the fuselage cross section for most of the fuselage length. (See figure 13.)

Cabin side panels came loose because of the downward compression of the fuselage ceiling. Both overhead racks had separated from their attach points. Although the galley remained intact, it separated from its upper attach points and its contents were scattered inside and outside of the cabin. Most seats separated from the structure at impact. Primary failures were in the seat support structures, just below the leg attachment to the

---

10/ Aircraft Accident Report: Mohawk Airlines, Inc., Fairchild Hiller FH-227B, N7818M, Albany, New York, March 3, 1972, (NTSB-AAR-73-8).

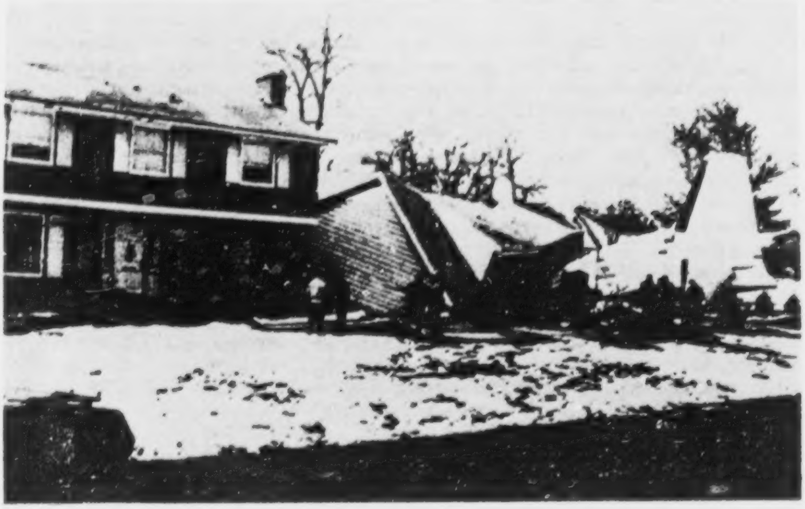


Figure 12.--Aircraft lodged in house.

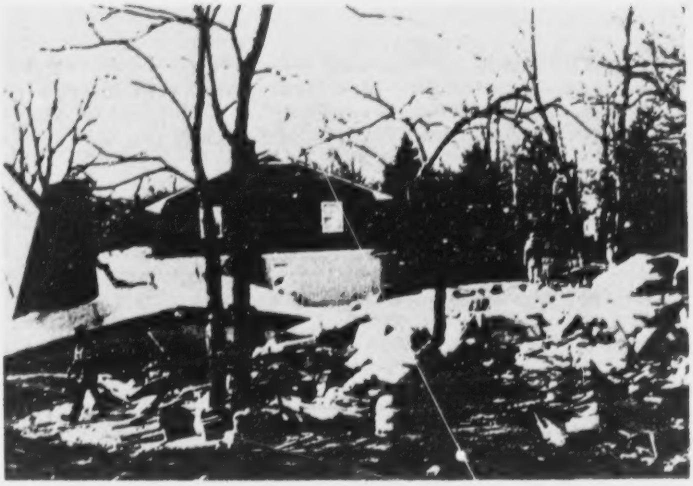


Figure 13.--Aircraft after house was torn away.

seat chassis. The failures consisted of bending or complete fracture of the seat legs in both the downward and sideward directions. (See figure 14.)

In addition, the front seat-to-track attach fittings, seat backs, seat pans, and arm rests failed. The seat back tray tables, although damaged to varying degrees, remained latched in most cases. The seat tracks also exhibited various degrees of failure throughout the cabin.

Of the 48 persons on board, 16 were killed, and 32 were injured seriously. Generally, the fatally injured persons exhibited skull fractures, spinal fractures, brain damage, ruptured aortas, crushed chests, fractured ribs, and fractured extremities. The survivors exhibited injuries such as spinal injuries, which occurred in 18 cases, concussions, fractures of the skull, face, ribs, sternum, clavicle, arm, and pubic bone, and various other internal injuries. Ankle and leg fractures were suffered by 19 survivors. Only one survivor escaped from the aircraft unaided. All injuries were attributed to the loss of restraint caused by failure of the tiedown chain.

The flight attendant seat which failed was designed for load factors of 9.0g forward, 6.5g downward, and 1.5g sideward. The passenger seats were designed for load factors of 9.0g forward, 7.5g downward, and 3.0g sideward. A study of the forces generated by the aircraft's impact with the residence gave estimated forces of 15 to 25g forward, 5 to 15g downward, and 5 to 10g sideward.

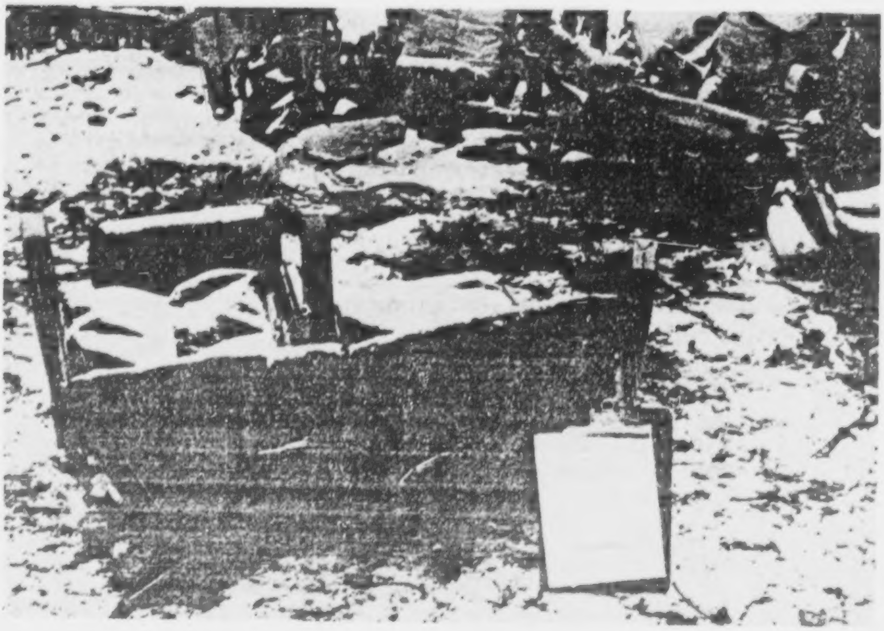


Figure 14.--Typical failure mode of passenger seat. (Note direction of failure of seat legs and left arm rest of this left hand seat unit.)

With regard to survivability in this accident, the Safety Board has drawn the following conclusions:

- This was a severe accident with forces approaching but not exceeding the limits of human tolerance to acceleration for occupants restrained only by a seatbelt.
- Although the fuselage was deformed and the floor was split up the middle for almost the entire length of the cabin, the floor structure on each side with the floor tracks attached stayed essentially intact and should have been capable of retaining the seats with the occupants.
- The seats failed under combined loading in the downward and sideward directions which is a foreseeable event that can be detected under dynamic test conditions and corrected.
- All of the injuries sustained in this crash were typical of those caused by high velocity impacts after loss of restraint.
- If fire had occurred, all but one survivor would have died.

In summary, the following general conclusions were drawn from the five case histories:

- Failures of cabin furnishings and seats are occurring in different types of accidents regardless of severity.
- Some seats are designed for loads in excess of those required by FAA, but less than those estimated to have occurred in these accidents.
- Failures of seats and furnishings injure, trap, and incapacitate occupants, and create obstacles to egress.
- Because of unpredictable postcrash factors such as fire, time to escape is limited severely.
- Aircraft fuselages are able to provide adequate protection to the occupants even in the more severe accidents.
- Seats and other cabin furnishings are failing under combined loads acting in different directions simultaneously.
- Occupants are surviving the higher crash forces, but are receiving fatal impact injuries caused by loss of restraint, or are dying needlessly in postcrash fire because injuries or entrapment preclude escape.
- There is a demonstrated need to design the tiedown chain and other cabin furnishings for higher loading conditions which are more representative of actual crash experience.

DISCUSSION

Regulations and Standards

The regulations dealing with the ability of an aircraft to withstand crash forces are found in two different subparts of 14 CFR 25, Airworthiness Standards: Transport Category Airplanes. For cabin crashworthiness and occupant protection, the specific regulations are 14 CFR 25.561, Emergency Landing Conditions--General; 14 CFR 25.785, Seats, berths, safety belts, and harnesses; 14 CFR 25.787, Stowage compartments; and 14 CFR 25.789, Retention of items of mass in passenger and crew compartments and galleys.

The most important regulation in this group, 14 CFR 25.561, is the foundation for the other three regulations. It has two main sections, one of which deals with forces felt by the occupant and one of which concerns the retention of cabin furnishings.

Forces on the Occupant.--The regulation (14 CFR 25.561) states that the structure must be designed so that it gives each occupant "every reasonable chance of escaping serious injury in a minor crash landing" when three conditions are met. The first condition is that proper use is made of the seats, seatbelts, and other safety provisions. The second condition is that the aircraft's wheels are retracted if the aircraft has retractable gear. The third condition is that the forces experienced by the occupant and "acting separately relative to the surrounding structure" are equal to or less than 2.0g upward, 9.0g forward, 1.5g sideward, and 4.5g downward. The regulation further states that a lesser force in the downward direction may be used. This is the force which will not be exceeded when the aircraft absorbs the loads which result from an impact, at design landing weight, with a descent velocity no greater than 5 feet per second (300 feet per minute).

This regulation, in effect, defines a "minor crash landing;" that is, a wheels-up landing for aircraft with retractable gear at a reduced rate of descent on a level surface, such as a runway, with no obstacles. However, typically, aircraft involved in crashes encounter some obstacles, even those which crash on runways, and many aircraft crash over uneven terrain. Also, few wheels-up landings occur with these types of aircraft. Therefore, the accident described in the regulation does not represent adequately the real-world accident environment.

Accident experience has shown that humans survive in crashes that involve relatively high forces. Recognizing that human tolerance limits are considerably higher than the load limits cited in 14 CFR 25.561, two other factors become apparent. First, the current fuselage structures are doing a relatively good job of protecting occupants in crashes with large forces. Second, the limiting factor for survival in these crashes is not human tolerance limits; instead, it is the lethal nature of the environment inside the fuselage.

The use of cadavers, animals, dummies, or even the best computer models cannot reproduce exactly the reactions of live humans to various acceleration forces, and the obvious dangers involved in using human volunteers for these studies make it unlikely that much new knowledge of human tolerance will be gained in the near future. However, the Safety Board believes that sufficient data already exists in this area to support and substantiate design and development of environments that will be better able to protect the occupants of aircraft under a broad range of crash conditions.

Retention of Cabin Furnishings.--Retention of cabin furnishings is dealt with in a limited way in the second part of 14 CFR 25.561. In the regulation, furnishings are referred to as "items of mass." The regulation states that the supporting structure for each of the items of mass that could injure an occupant if it came loose in a crash landing must restrain these items. Thus, these items must be restrained only to the loads cited--9.0g forward, 4.5g downward, 1.5g sideward, and 2.0g upward.

In 1972, the regulations were amended to deal more comprehensively with the retention of items of mass in both passenger and crew compartments and galleys. The new regulation, 14 CFR 25.789, requires that some means be provided to keep the items of mass from becoming hazards by shifting when subjected to maximum load factors under specified flight loading and ground loading conditions, as well as the loads in 14 CFR 25.561. It also requires that each interphone remain in its stowed position when subjected to the loads specified in 14 CFR 25.561. The ground load criterion deals with the conditions under which the landing gear and aircraft structure must withstand specified inertia loads in the downward, forward, and sideward directions experienced in normal ground operations. The flight load criterion relates to the aerodynamic load criterion acting on the aircraft for specified aircraft weights and altitudes in the normal operating envelope.

Stowage compartments located in the cabin, in which such items as cargo, baggage, emergency and other equipment, and carry-on articles are stowed must also be designed to withstand the loads specified by 14 CFR 25.787 in addition to those specified in 14 CFR 25.561. Each of these compartments must be designed to retain its maximum allowable weight under these load factors. The regulation also states that there must be a means to prevent the articles in these compartments from shifting and becoming hazards within the specified loads.

Accident experience has shown that stowage compartments do not meet the intent of the regulation to keep their contents from becoming hazards by shifting when subjected to the specified ground, flight, and crash forces. The accident and incident cases cited in this study show that objects are released from the compartments, injuring occupants and hampering egress.

The last major regulation dealing with the design of cabin furnishings, 14 CFR 25.785, deals with seats, berths, safety belts, and harnesses. The regulation begins by reiterating the requirement in 14 CFR 25.561, which states that these items must be designed so that a person making proper use of the safety equipment will not be injured seriously in a crash landing as a result of the forces specified in 14 CFR 25.561. It further states that each occupant must be protected from head injury by a safety belt and at least one of the following: (1) shoulder harness (2) the elimination of injurious objects within the strike envelope of the head, and (3) an energy absorbing rest that is capable of supporting the head and upper torso.

The regulation states that the determination of the strength of the attachment of the seat to the structure and the attachment of each belt or harness to the seat must at least be equal to the forces specified in 14 CFR 25.561 mutiplied by a factor of 1.33. This means that while the passengers may be allowed to feel the specified inertia loads, the seat and seatbelt connections must withstand forces one-third greater.

Accident experience has also shown that the requirement of 14 CFR 25.785 to provide protection for each occupant from head injury is not being met. In typical fixed-wing, nonmilitary transport aircraft, forward facing seats are used, and the typical accident involves forces applied mainly from the front. In such cases, it is not feasible to protect the occupant with an energy absorbing rest to support the head and upper torso. Also, in seats other than those for the crew, no shoulder harnesses are available, leaving only the possibility of protecting passengers by eliminating injurious objects within the strike envelope of the head.

Figure 15 shows the strike envelope of a 95th percentile army aviator, restrained by lap belt only. Although the body measurements are not representative of the airline passenger population as a whole, they probably represent at least part of the upper percentiles of the aircraft passenger population in terms of size and weight. In this case, the head will travel through an arc where maximum extension is about 45 to 50 inches forward of the seat back. The seat pitch (the distance between similar points on seats in the next row forward or behind, measured horizontally) in air transport aircraft averages about 32 inches. Figure 16 shows the relationship of the strike envelope to seat position in this case. With a lap belt only, the seats become injurious objects within the head strike envelope. This would also be true for individuals whose statures are less than that of the 95th percentile model. Notice also the flailing envelope of the arms and legs. Injuries to these extremities incapacitate occupants so that they are unable to easily release their seatbelts because of arm and hand injuries, or to evacuate the aircraft because of leg and foot injuries. Flailing body extremities which contact other seats also contribute to the loads acting on those seats, increasing the chances of the seats failing. 11/

Tests on head impact tolerance have shown that the force levels necessary to cause skull fractures generally are high. Spread over a 3-square-inch area of the forehead, forces of about 200g or greater can be tolerated. Considerably higher levels can be tolerated if the impact is spread evenly over the entire face. However, skull fracture is only one type of injury which can occur when the head strikes an object during acceleration. Internal head injuries, such as concussion, can occur with or without skull fracture and are more difficult to measure. 12/ Even with seat backs padded with energy absorbing material, the head and face can still be injured. FAA studies 13/ have shown that head velocities in 8g crash decelerations can reach 50 feet per second, and that padding commonly used on seats is insufficient to protect passengers against head injury. Although the seatbacks in transport aircraft are designed to fold forward when 35 pounds of pressure are applied, injuries are still occurring when occupants strike seatbacks. The accidents cited in this study as well as others have demonstrated this point. Although not all of these injuries are serious, requiring extended hospital stays, they can cause at least temporary incapacitation, which may lead to death because of postcrash factors.

An individual is much better protected from head injury with the shoulder harness, even with a reduced seat pitch. (See figure 17.) In addition, the occupant's tolerance to forward acceleration would be increased greatly.

In summary, the Safety Board concludes that occupants of large transport aircraft are not protected adequately in a minor crash landing. Further, the Safety Board concludes that 14 CFR 25.561 does not represent adequately the actual accident experience of transport aircraft, and that because of this, the passengers and crew are not receiving protection in survivable and partially survivable crashes where it is most needed.

This study has shown that aircraft occupants are being injured, trapped, and killed in survivable accidents. Many deaths and injuries are directly attributable to failures of seats and cabin furnishings. However, most of these accidents involved forces greater than those specified in 14 CFR 25.561. For these cases, the failures are to be expected, even if the minimum standards for design are met.

11/ Swearingen, J.J., Hasbrook, A.H., Snyder, R.G., McFadden, E.B. Kinematic Behavior of the Human Body During Deceleration, 62-13, FAA Civil Aeromedical Research Institute, June, 1962.

12/ Hodgson, Voigt R., and L.M. Thomas, "Head Injury Tolerance," Aircraft Crashworthiness, Saczalski, et. al., The University Press of Virginia, 1975.

13/ Swearingen, John J., Evaluation of Various Padding Materials for Crash Protection, AM 66-40; General Aviation Structures Directly Responsible for Trauma In Crash Decelerations, FAA-AM-71-3, FAA Office of Aviation Medicine.

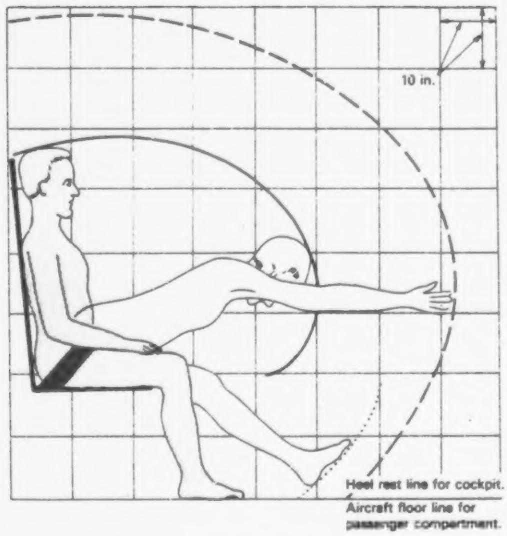

10 in.
Heel rest line for cockpit.
Aircraft floor line for passenger compartment.

Figure 15.--Lap-belt-only extremity strike envelope-side view. (From Crash Survival Design Guide, USARTL-TR-79-22.)

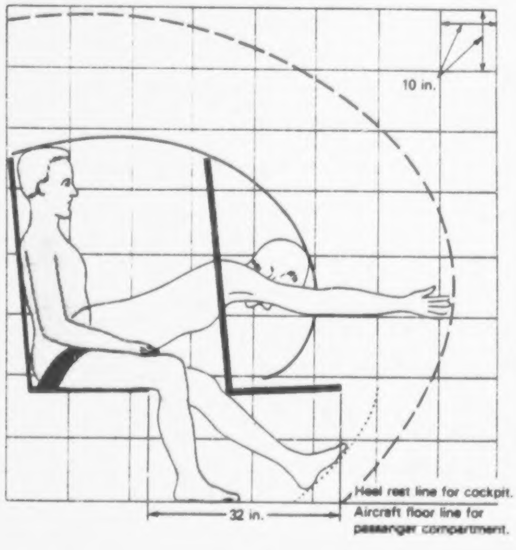

10 in.
Heel rest line for cockpit.
32 in.
Aircraft floor line for passenger compartment.

Figure 16.--Lap-belt-only extremity strike envelope-side view. (From Crash Survival Design Guide, USARTL-TR-79-22.)

The FAA has stated repeatedly that humans cannot withstand forces much greater than those for which seats are presently designed, 14/ and has used this assumption as part of its argument for not upgrading seat standards. As this study has shown, there is ample evidence from accident cases as well as research to show that human tolerance levels are significantly greater than the FAA officially maintains. The evidence includes a substantial body of work done within the FAA itself. Most of the accident cases in this study have indicated that the limiting factor in survival is not human tolerance to crash forces, but rather the lethal nature of the aircraft interior and the inability of the tiedown chain to restrain the individuals.

The Safety Board believes that treating crashworthiness and occupant protection in separate subparts of 14 CFR 25 and not in one consolidated section also has contributed somewhat to the lack of progress in this extremely important area. The regulations pertaining to these areas are now found in various sections of 14 CFR 25 under different headings of the following subparts.

- Subpart C - Structure
    - Emergency Landing Conditions
- Subpart D - Design and Construction
    - Personnel and Cargo Accommodations
    - Emergency Provisions
- Subpart F - Equipment
    - Safety Equipment

The fact that the FAA has never consolidated these regulations into a single subpart, or placed any other emphasis on crashworthiness, may have contributed to the reluctance of industry to incorporate new technology or to take advantage of crashworthiness design philosophies. The Safety Board believes that creating a single subpart for crashworthiness and occupant protection would reflect the increased emphasis by the FAA on this important aspect of aircraft design and construction. Further, regulations concerning safety and occupant protection could be consolidated and coordinated.

Design Technology

The Safety Board did not attempt to gather and evaluate all available design and testing technology, since it is not its role to attempt to provide specific solutions for the engineering problems disclosed by its investigations. The Safety Board believes that the following summary clearly illustrates that improvements in designing and testing aircraft cabin components can be made.

Perhaps the best summary of current design technology for seats and restraints is Volume IV of the Aircraft Crash Survival Design Guide. The guide presents a philosophy and goals of crashworthy seat and restraint design and gives an overview of the methods available to accomplish these goals. It critiques different methods, test results, and results of actual experience. Although the design guide was intended for use primarily on light fixed- and rotary-wing aircraft used by the military, the technology is transferable to larger aircraft.

14/ One of the most recent of those statements was made in hearings before the Subcommittee on Oversight and Review of the Committee on Public Works and Transportation, House of Representatives, June 3-5, and September 10, 1980, and is in report 96-60, "Cabin Safety: "Safer Committee" Update (Aircraft Passenger Seat Structural Design)."

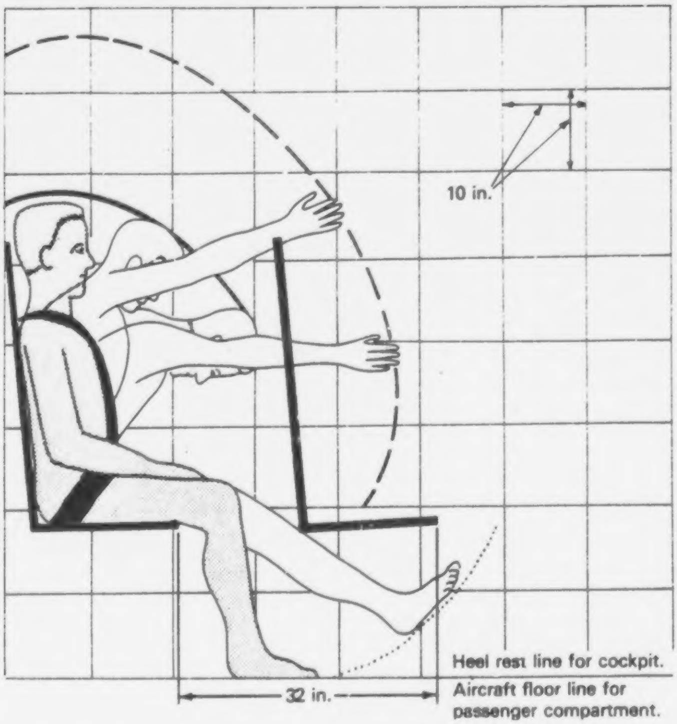

10 in.
Heel rest line for cockpit.
Aircraft floor line for passenger compartment.
32 in.

Figure 17.--Full-restraint extremity strike envelope-side view.
(From Crash Survival Design Guide.)

With regard to the choice of proper materials in design, the Guide recommends that materials with good strength-to-weight ratios and high ductility be used. In choosing materials to enhance crashworthiness, their behavior after permanent deformation begins is important.

Different types of structural connections are also discussed. Tiedown chain failures caused by floor distortion, bulging, or warping are identified as major problems in crashes of transport aircraft. One of the design configurations presented to accommodate these distortions is the use of a "plastic hinge" at the seat-to-floor track attach point. The hinge is actually a highly ductile material which will deform without failure up to a certain point as the floor is displaced. Another design modification suggested is the use of a ball and socket joint at the seat-to-floor track attachment. These and other methods presented are all designed to allow the seat and occupant to remain in place while the floor is displaced. Design methods are provided for floor-mounted, bulkhead-mounted, and sidewall-mounted seats, all of which are used in transport aircraft.

Critical parts of the tiedown chain include the floor and subfloor structures. These must be compatible with the seat design so that high stresses will not be concentrated in one area, causing premature failure. In 1963, studies 15/ of the tiedown chains in three U.S. Army aircraft showed that the crash strength of these systems could be improved by a factor of 2 while adding only a small amount of weight. One of the improvements was in the strength of the floor tracks, a major problem in transport aircraft crashes. Studies suggested putting small aluminum collars on the seat track tiedown bolts between the nut and the floor. The collars, which compressed before the bolts broke, helped to spread the load and allow the seat tracks to deform without failures up to twice the ultimate tiedown strength before installation of the collars.

Energy absorption in a crash is a combination of the crushing of the airframe, landing gear, and landing surface. In many cases, however, there is a large amount of energy remaining, which will be transmitted to the occupant. This additional energy may be absorbed by the seat through the use of load-limiting or energy-absorbing devices. These devices are set to preselected values. In a crash, they absorb energy by providing a resistive force over a certain distance, allowing the occupant to come to a stop over a longer distance and thereby decreasing the average load acting on the occupant. Information on and comparisons of nine of the most common of these devices are provided in the Guide. Information from research conducted by Government and industry on load-limiting devices is also provided.

The Guide also provides information on types of restraint systems and methods of installation. It explains that when a shoulder harness is used, but lap belt tiedown straps are not used and the seatbelt anchor point is not correct, force on the shoulder harness can pull the lap belt up, allowing the occupant to submarine, or slide under the belt, causing injuries. Submarining can also occur when only a lapbelt is used and the anchor point is not correct. The FAA has cited these injuries to demonstrate that human tolerance to acceleration when restrained by lap belt only is relatively low. This, in fact, demonstrates only how poorly designed restraint systems can add to injury.

As pointed out in this study, if cabin furnishings fail in a crash, the furnishings or items released from them can become missiles in the cabin. They can cause injury directly by striking occupants, or they can block egress paths. They can also strike seats, imposing even greater loads on them and thereby induce failures in the occupant restraint systems. For these reasons, it is important that these furnishings, or items of mass, be restrained to loads equal to or greater than those of the seats. In most cases, this should not cause a problem in design or impose penalties of additional weight. For heavier items, however, the use of load-limiting devices like those for seats is recommended.

Testing Technology

The accident cases presented in this study have shown that crash environments are extremely complex and variable during the crash sequence. Forces acting on the aircraft and its interior do not act separately, but in various and unpredictable combinations. For some time, the Safety Board has advocated the use of dynamic testing of items in the tiedown chain and other items of mass in the aircraft cabin. 16/

15/ Haley, J.L., Jr., and Avery, J.P., Ph.D., Personal Restraint Systems Study - HC-1B Vertol Chinook, AvCIR 62-26; HU-1A and HU-1B Bell Iroquois, AvCIR 62-27; CV-2 de Havilland Caribou, AvCIR 62-16, Aviation Crash Injury Research (AvCIR), Division of Flight Safety Foundation, Inc., Phoenix, AZ.

16/ The Board has made the following safety recommendations on this subject: Recommendation Number 63-33 (November 8, 1962), Recommendation Number CY 70-42 (August 28, 1970), Recommendation Number A-75-051 (June 2, 1975), and Recommendation Number A-80-131 (December 17, 1980).

Regulation 14 CFR 25 provides basic information on the minimum standards these items are to meet, and 14 CFR 21 (formerly 14 CFR 37) provides the specific requirements. This part, titled "Technical Standard Order Authorizations," prescribes the minimum performance standards and quality control standards for various articles used on aircraft through the use of Technical Standard Orders (TSO). Aircraft safety belts and seats are regulated under this part. For these aircraft cabin furnishings, only static testing is required. Static testing is used to verify that the system and its components possess the required strength and other desired properties in the principal loading directions. The response of the system or its components can be observed as the forces are applied slowly. TSO-C39a describes the minimum performance standards for seats and berths. For methods used in testing the seats, it refers to National Aircraft Standard (NAS) 809, which was approved in 1956 and has not been revised since. Seatbelt performance is governed by TSO-C22f, which refers to NAS 802, last revised in 1950.

Under the prescribed test methods, the applied loads during seat testing are assumed to be acting separately in each major direction. While these forces may be evaluated in combination, it is not required. Also, there are no provisions or requirements for statically testing the seats under conditions which simulate floor warping.

A more realistic test environment is provided by dynamic testing. Some materials react differently to forces applied rapidly under dynamic test conditions than they do to slowly applied forces. Under dynamic conditions, unexpected failures may occur which could not be predicted on the basis of static test results. There are different types of dynamic testing, however. In general, both industry and the FAA, which has done much research on dynamic test methods, refer to unidirectional dynamic tests. While providing a much improved idea of seat response under crash conditions, unidirectional testing still does not adequately replicate actual crash dynamics.

The Design Guide describes a method for dynamically testing seat systems in more than one axis simultaneously. The Safety Board believes that this is the best method currently available for dynamic testing, because it involves the components of the seat system reacting together under conditions in which forces are applied simultaneously from different directions. This type of force application represents more accurately the environment in an actual crash.

As noted, the requirements for design and testing of seats and restraints presented in the Design Guide are for use specifically in light aircraft, both fixed- and rotary-wing. Requirements for larger aircraft differ somewhat because of the increased amount of crushable space beneath the seats, and the overall mass of the aircraft. Simula Inc., which prepared the latest revision of the Design Guide, has distributed a paper describing a seat system design and test regime for transport category aircraft. (See appendix B.) This paper was submitted to the FAA's official docket in response to its 1980 hearings on transport aircraft seat strength. It discusses requirements for three size categories of aircraft, based on the amount of crushable space available in each category. As aircraft size increases and more space is available below the floor to crush and absorb energy, less energy must be absorbed by the seat. Thus, there is a need for differing requirements.

The first of the categories is small aircraft, usually having a capacity of less than 50 passengers, which have less than 36 inches of crushable space below the floor. The second category is medium size aircraft, generally holding from 50 to 249 passengers, which have more than 36 inches but less than 60 inches of crushable space. The final category is large aircraft with a seating capacity of 250 or more passengers, which have more than 60 inches of crushable space. The following tabulation provides the test requirements suggested for use by Simula Inc., in each category.

Parameter	Small (Less than 36 in.)	Medium (36-60 in.)	Large (More than 60 in.)
Time (sec)	0.109 - 0.147	0.128 - 0.140	0.155 - 0.175
G's	19 - 22	17 - 20	14 - 16
Minimum velocity change (ft/sec)	50	50	50

These requirements are measured in two tests. The first test is to ensure that the vertical load-limiting capabilities of the seat system operate satisfactorily under conditions of simultaneous forward and sideward loading. The second test is to ensure that the seat system is able to withstand the design pulse forces when applied simultaneously in the forward and sideward directions. These design and test methods can be applied to all transport category aircraft covered by this study as well as the smaller transport aircraft, all of which are regulated by 14 CFR 25.

Crashworthiness Work

In the early 1960's, FAA and other Government agencies, including the military, cooperated with industry in a series of contract studies of crashworthiness. These studies added to and expanded the concepts and knowledge gained in the 1940's and 1950's. Part of this work included full scale crash tests of a Lockheed Constellation and a Douglas DC-7, both of which contained various experiments including experiments dealing with seats, restraints, and the overall acceleration environment. Much of the information from these tests and previous research and development were incorporated into the first Crash Survival Design Guide, published in 1967. 17/ Both Government and industry actively disseminated the new information on various aspects of crashworthiness to the public. A substantial number of these papers were published by FAA in the late 1960's, many of which included recommendations for upgrading the minimum standards of 14 CFR 25.561. However, FAA did not change the regulations based on the results of these studies. The design and test methods are used on a regular basis only by the Army. The crashworthiness design principles proved to be so effective that the Army turned many of them into contract requirements for all of its aircraft.

In the previously referred to FAA 1980 hearings on seat strength, testimony was given based in part on the results of the crash tests of the Constellation and DC-7 and on other crash information, including more recent data on jet aircraft. The FAA expressed reluctance to accept the validity of the testimony as it relates to the accident experience of today's air carrier fleet. The reasoning behind this apparent reluctance was that the designs of modern aircraft and the materials used in them differ substantially from those of the large piston-powered and older turboprop-powered aircraft. Therefore, the FAA concludes, the structures will react differently in a crash.

The FAA is once again working with other Government agencies and industry to define crash scenarios and failures or inadequacies in structures which lead to injury or death in crashes and to identify candidate areas for further research and development programs. This current crashworthiness program was started in 1980 and is scheduled for completion at the end of 1985. The culmination of the program will be the full scale crash test of a Boeing B-720 aircraft. This will include the test of a currently manufactured airline seat which will be modified by Simula Inc., to include load attenuating devices.

17/ Original edition of the Aircraft Crash Survival Design Guide cited previously in this study.

Although it should be possible to conduct many worthwhile experiments and to gather new data in this test, the Safety Board questions whether the FAA will be any more willing to accept such crash data as being representative of modern aircraft. The type certificate of the B-720 was applied for on April 12, 1957, only 7 years after the DC-7 type certificate application. The regulations in effect on that date are those that the aircraft was required to meet. In this case, they were CAR 4b - Airplane Airworthiness Transport Categories, the forerunner to the current Part 25 of the Federal Aviation Regulations (14 CFR 25).

Physically, the B-720 resembles a B-707. Like the Constellation and DC-7, it is a narrow body aircraft with four wing-mounted engines. Although they are jets mounted under the wing instead of piston engines mounted in the wing, the overall weight distributions of these aircraft are similar. Since the B-720 operates at higher altitudes, the difference between cabin pressure and outside pressure is greater; therefore, its fuselage is probably stronger in this area. However, these aircraft are all made of essentially the same materials.

Many of the more modern aircraft are wide bodied and have at least one tail-mounted engine, which gives them different weight distributions. Perhaps even more important is the fact that the materials used to build modern aircraft are changing rapidly. More and more, advanced composite materials are being used to fabricate major structural components of the aircraft. Composites are also being used in the aircraft interiors for seats and other structures. Although studies on the crash characteristics of smaller composite structures are now being studied, little is known about how larger composite structures will react in a crash. Also, little is known about reactions of composite cabin furnishings, such as seats, in a crash. 18/

A new generation of aircraft which make more extensive use of composite structures is already in production and the FAA's current crashworthiness program will investigate some of the areas dealing with new structures. Assuming that this current program stays on schedule and provides what the FAA considers sufficient data to support rulemaking, it is highly unlikely that any changes in the regulations will occur before 1990. Assuming that a new or amended regulation becomes effective on that date, it will affect only those aircraft making initial application for type certificates on or after that date. With an average of about 4 years between type certificate application and final approval, it is unlikely that major improvements in aircraft crashworthiness based on the current program will be seen much before the year 2000, another 20 years. Morever, the Safety Board is concerned that, since this crash test will add only one more data point to an already established data base which the FAA has previously rejected as adequate evidence to support rulemaking, the FAA's reluctance to upgrade the crashworthiness regulations will continue.

The Safety Board believes that there is sufficient data currently available to support the upgrading of the occupant crash protection standards in the regulations; and further, that the substantial body of knowledge and practical experience in design, construction, testing, and use of crashworthy structures and cabin furnishings can be applied successfully to large transport aircraft, in many cases without substantial penalties in cost or weight and without major modifications to existing structures. The Safety Board also believes that the FAA should concentrate its efforts on applying available technology to transport aircraft, and in newer areas, such as crashworthiness of composites, instead of continuously reevaluating past work that has been proven valid through actual use for at least 10 years, in both the aviation and automotive industries.

18/ A compilation of data on composite structures recently published by the Army is in Investigation of the Crash-Impact Characteristics of Advanced Airframe Structures, USARTL-TR-79-11, Applied Technology Laboratory, U.S. Army Research and Technology Laboratories (AVRADCOM), Fort Eustis, Virginia.

CONCLUSIONS

1. Seat systems and other cabin furnishings are failing in accidents/incidents where the acceleration forces acting on the aircraft and occupants are less than the design forces prescribed by 14 CFR 25.561.

2. Human tolerance to abrupt accelerations when restrained by lap belt only is two to three times greater than the force levels cited in 14 CFR 25.561.

3. Most of the survivable and partially survivable accidents/incidents analyzed in this study involve acceleration forces acting on the aircraft and occupant that are in excess of the levels cited in the regulations.

4. The fuselage structure of current aircraft is able to provide adequate protection for occupants in accidents involving forces considerably in excess of the requirements of 14 CFR 25.561.

5. Aircraft occupants are being injured and killed because of the failure of seat/restraint systems and other cabin furnishings in survivable and partially survivable accidents.

6. Failed seat systems and cabin furnishings trap occupants or become obstacles to rapid egress, thereby increasing greatly the potential for fatalities caused by postcrash factors.

7. The regulations and standards governing crashworthiness of cabin furnishings have not been upgraded for about 30 years.

8. Consolidation of the crashworthiness regulations in one subpart of 14 CFR 25 could contribute to progress in this area.

9. There is sufficient data currently available regarding human tolerance and crashworthiness to demonstrate the need for and the feasibility of upgrading the applicable regulations.

10. Crash scenarios are extremely complex and forces on the aircraft and its interior act from several directions simultaneously and in unpredictable combinations.

11. In addition to the inability of static testing to prove the adequacy of seat systems under dynamic conditions, the tests do not include consideration of conditions of warping and buckling of seat attachment structures, such as floor, side panels, and bulkhead.

12. Available crashworthiness design and testing technology should be implemented and should be upgraded periodically as state-of-the-art improves.

13. Requirements for multiaxis dynamic testing should be incorporated into seat system design and certification criteria.

14. Padding of aircraft interiors is insufficient to protect passengers against head injuries in these crashes.

15. Human tolerance to forward acceleration can be increased greatly, and head injury potential can be reduced greatly, by use of upper torso restraint.

16. The major emphasis of FAA's ongoing crashworthiness programs should be on applying available technology, and on improving state-of-the-art technology rather than reexamining proven technology.

17. Obstacles in the airport environment such as ditches, dikes and embankments, and nonfrangible structures, needlessly increase the severity of many accidents/incidents occurring on the airport.

RECOMMENDATIONS

As a result of this special study, the National Transportation Safety Board made the following recommendations:

--to the Federal Aviation Administration:

> Establish a separate single subpart in 14 CFR 25 which consolidates crashworthiness requirements for transport category aircraft pertaining to areas such as crash models, occupant protection requirements, emergency egress, retention of items of mass, and seat and seat restraint systems. (Class III, Priority Action) (A-81-139)
>
> Revise the crashworthiness requirements as presently described under Emergency Landing Conditions, 14 CFR 25.561, to eliminate reference to the term "minor crash landing," and to include a descriptive crash model determined from FAA's Transport Aircraft Crashworthiness Program. (Class III, Priority Action) (A-81-140)
>
> Establish and specify in the appropriate subpart of 14 CFR 25, interim standards for the design of seat and restraint systems and cabin furnishings to withstand the multiaxis acceleration levels such as those described by Simula Inc. in its Paper TI-8017. (Class II, Priority Action) (A-81-141)
>
> Establish and specify in the appropriate subpart of 14 CFR 25 and in the related Technical Standard Orders, interim standards for static and dynamic testing of seat/restraint systems, including consideration of warpage or buckling of the attaching structure, and multiaxis dynamic pulses such as those described by Simula Inc. in its Paper TI-8017 and in the Aircraft Crash Survival Design Guide. (Class II, Priority Action) (A-81-142)
>
> Establish an internal procedure which will ensure the periodic review of state-of-the-art crashworthiness design and testing technology and will reflect the improved technology through upgraded standards. (Class II, Priority Action) (A-81-143)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JAMES B. KING
Chairman

/s/ PATRICIA A. GOLDMAN
Member

/s/ G. H. PATRICK BURSLEY
Member

ELWOOD T. DRIVER, Vice Chairman, and FRANCIS H. McADAMS, Member, did not participate.

September 9, 1981

APPENDIXES

APPENDIX A

DEFINITIONS OF PHASES OF FLIGHT OPERATION

Taxi - From the time the aircraft first taxies under its own power until taking the active runway. Also, when the aircraft taxies off the runway until it parks at the spot of engine shutdown.

Takeoff - From the time the aircraft enters the runway up to and including the first airborne power reduction.

Climb - From the time of initial power reduction until the aircraft levels off at its cruise altitude.

Cruise - From level off at cruise altitude to departing cruise altitude.

Descent - From the beginning of the descent from cruise altitude to the Initial Approach Fix (IAF), Final Approach Fix (FAF), Outer Marker, or Visual Flight Rules (VFR) pattern entry whichever occurs first.

Approach - From the time the descent ends (either the IAF, FAF, Outer Marker, or VFR pattern entry) until the aircraft reaches the Missed Approach Point (MAP) under Instrument Meteorological Conditions (IMC), or runway threshold under Visual Meteorological Conditions (VMC). Includes missed approach (IMC) and go-around (VMC).

Landing - From either the MAP (IMC) or runway threshold (VMC) through touchdown until aircraft taxies off the runway.

APPENDIX B

October 13, 1980

TI-8017

TRANSPORT CATEGORY AIRCRAFT SEAT STRENGTH PROPOSED MODIFICATION TO FAR PART 25

Prepared by:

S. P. Desjardins
and
D. H. Laananen

Simula Inc.
2223 S. 48th Street
Tempe, Arizona 85282

1. INTRODUCTION

On the following pages are presented requirements for seat strength and the tests to be conducted in verifying those strengths. Occupant weights to be used in the design are defined, as are the required static design loads. Static tests to demonstrate the adequacy of the system in all loading directions are presented. Finally, dynamic test requirements, to demonstrate that the seat systems and restraint systems will provide the degree of protection desired, are also defined. Successful completion of all static tests and dynamic tests are required to demonstrate acceptability of a design.

The directions of applied loads are referred to in terms of forward or aftward, lateral or vertical, and upward or downward. These terms refer to seat loading in directions consistent with the aircraft coordinate system. Thus, a forward load on a forward-facing seat is in the positive x-direction with respect to both the seat and the aircraft. If the seat is a side-facing seat, the forward load would be applied to the seat in the plus-or-minus y-direction, depending on whether the seat faces right or left, respectively, in the aircraft. For an aft-facing seat, the forward load would be applied in the negative (-x)-direction toward the back of the seat.

2. OCCUPANT WEIGHTS FOR SEAT DESIGN AND TESTING

For design of single-occupancy seats, an occupant weight of 220 lb should be used. For multiple-occupancy seats, the seat should be considered fully occupied with a weight of 170 lb for each occupant.

The effective weight of a seated occupant in the vertical direction is approximately 80 percent of the occupant's total body weight because the lower extremities are partially supported by the floor. For downward loading of energy-absorbing seats the effective weight of the 50th-percentile occupant, 136 lb, should be used in determining the limit load for the energy-absorbing system and for static testing. This 136-lb effective weight should be used in the downward direction for all energy-absorbing seats, whether single- or multiple-occupancy, and all such seats should be fully occupied.

3. AIRCRAFT SIZE CATEGORIES

In defining seat strength requirements it will be noted that the loads depend on aircraft size, as defined by passenger capacity. A certain degree of energy-absorbing capability below the floor has been assumed for each category, and, should a given aircraft possess less than the minimum assumed underfloor structure, the aircraft will be treated in the next smaller size category.

4. STRENGTH REQUIREMENTS

Required load factors for seat design are presented in Table 1. The static loads that the seat must withstand are obtained by multiplying the load factors by the sum of the seat weight and the total occupant weight, as defined in Section 2.

4.1 DOWNWARD LOADS - SMALL AIRCRAFT

Human tolerance to vertical impact limits the acceptable forces in the vertical direction for all aircraft seats. Therefore, for the small aircraft (less than 50 passengers or less than 36 in. of underfloor structure), energy absorption in the vertical (downward) direction must be provided. The seat should be designed for a minimum of 8 in. of stroke. The seat should stroke at a load of 12 ± 2 times the combined weight of the seat and effective weight of occupants at 136 lb per person.

TABLE 1. SEAT DESIGN AND STATIC TEST REQUIREMENTS

Fuselage Size Loading Direction	Required Load Factor (G)		
	A. Small (Less than 50 passengers	B. Medium (50-249 passengers)[a]	C. Large (250 or more passengers)[b]
Forward	21	18	15
Lateral	12	10	8
Downward	12 ± 2[c]	10	8
Upward	8	6	4
Aftward	12	10	8

(a) Any aircraft possessing less than a 36-in. depth of fuselage structure below the floor must meet requirements of Category A (small).

(b) Any aircraft possessing less than a 60-in. depth but at least 36 in. of fuselage structure below the floor must meet requirements of Category B (medium).

(c) Energy-absorbing stroke is required, as explained in Section 4.1. Occupant weight for downward loading of a Category A seat should be the effective weight of 136 lb.

4.2 ATTACHMENT OF SEATS TO AIRCRAFT

Attachments to aircraft structure on floor or bulkheads must be capable of retaining the seat under its design loads, considering the effects of warping as discussed in Section 5.

Load-limiting between the seat and floor provides a potential alternative to increased floor strength in retrofit applications. However, it must be demonstrated by dynamic testing that injury potential will not be aggravated by the energy-absorbing seat displacement resulting from the use of load-limiting. For example, a fully occupied seat located behind an empty seat would be expected to stroke toward the empty seat under forward loading. The reduction in space between the seats should be demonstrated to be nonhazardous.

5. STRUCTURAL TEST REQUIREMENTS

Both static and dynamic tests are recommended. Dynamic tests of aircraft seats have shown that individual components capable of maintaining the design loads often fail when tested in combination with other components. This could be a result of inaccurate analyses. However, it is recommended that all seat systems be tested as complete units. This is not to imply that component tests are not useful. Component tests can be extremely useful and should be used wherever possible to verify required strengths. This practice is particularly valid where finite-element analyses have been used to accurately predict distribution of loads in redundant structures.

Upon certification of prototype systems tested under both static and dynamic conditions, no further tests should be required. Major structural design changes in the basic seat system will require static retesting of the new system to ensure that no loss in strength has been caused by the design changes. If the changes could affect the energy-absorbing, or stroke, performance of the seat (Category A), additional dynamic tests should also be conducted. Major structural design changes are those changes involving principal load-carrying members such as floor, bulkhead, or ceiling tiedown fittings, structural links or assemblies, seat legs, or energy-absorbing systems. Minor changes, such as in ancillary fittings, can be accepted without a structural test. In summary, changes that increase loading, decrease strength, produce significant changes in load distribution, or affect the stroking mechanism will require retesting.

All testing is to be conducted with the seat cushions in place and, for pilot seats with adjustments, the seats should be in the full-up and full-aft positions unless another position is shown to be more critical.

5.1 STATIC TEST REQUIREMENTS

5.1.1 General

The purpose of the static tests is to demonstrate that the seat has the strengths and other properties required to provide the desired performance in all the principal loading directions. Static testing enables basic properties to be ascertained for known loads applied at a slow enough rate so that seat response can be observed. Successful completion of the static tests does not guarantee passing the dynamic tests, but it improves the chances. Weaknesses can be identified and corrected prior to conduct of the ultimate dynamic tests. Also, due to the loading rate sensitivity of materials, load distributions may be different in dynamic tests from those in static tests. Certain structures, statically soft, may react as stiffer members under dynamic loading, and thus, pick up more of the load than when the system was loaded statically.

Table 1 presents the static test requirements for complete seat units. The tests required include a series of unidirectional tests to determine basic seat strengths along the major axes. The loads should be applied separately, and seats must demonstrate no loss in structural integrity during these tests and should demonstrate acceptable energy-absorbing capacity (Downward - Category A). All static tests should be conducted under simultaneous conditions of floor buckling and warping as illustrated in Figure 1 or bulkhead warping as illustrated in Figure 2. The warping conditions must be introduced in the static test phase to evaluate completely the performance of the seat under the most severe requirements selected for design.

APPENDIX B

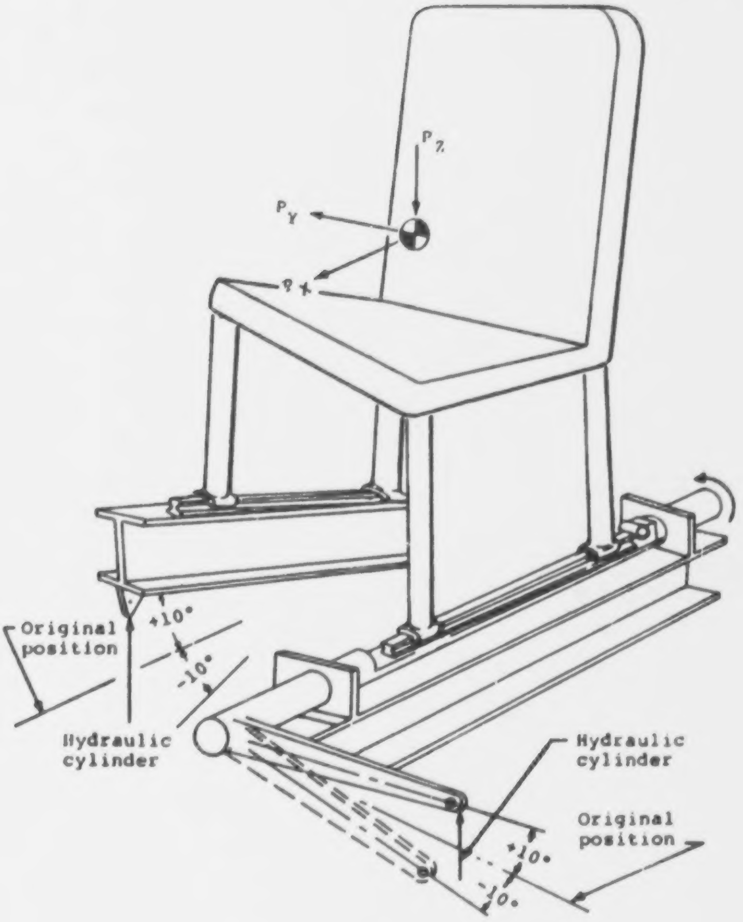

P
Z
P
Y
P
X
Original position
+10°
-10°
Hydraulic cylinder
Hydraulic cylinder
Original position
+10°
-10°

Figure 1. Suggested method of applying floor warp and twist during static loading of seats.

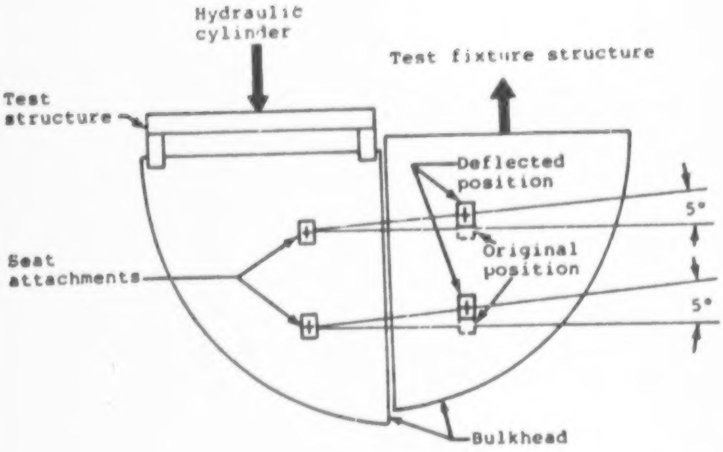

Hydraulic cylinder
Test fixture structure
Test structure
Deflected position
Original position
Seat attachments
5°
5°
Bulkhead

Figure 2. Suggested method of applying bulkhead warping for static testing of seats.

5.1.2 Load Application Method

The static test loads are to be applied at the expected center-of-gravity location of the occupant or occupants of each seat. The loads should be applied through a body block (see Section 5.1.3) restrained in the seat with the restraint system. Figure 3 shows the location of the center of gravity that should be used as the initial static load application point for the seat occupant.

The test load calculated by multiplying the weight of the occupant plus the weight of the seat by the required load factor should be applied continuously, or in not more than 2-G increments while the load-deformation performance of the seat is recorded. Maximum loads need not be held for more than 1 sec. The maximum load reached, regardless of duration, is to be used to assess compliance.

5.1.3 Static Load Body Block

The static test loads must be applied through a body block contoured to approximate a 95th-percentile occupant seated in a normal attitude. The body block must contain shoulders, neck, and upper legs. The upper legs should be contoured to simulate the flattened and spread configuration of seated thighs and to allow the proper location of the buckle. Critical pelvis dimensions are shown in Figure 3. The leg stubs should be configured to permit proper seat pan loading as the body block rotates forward under longitudinal loading; i.e., the leg stubs should be only long enough to provide a surface to react the lap belt load. The side view of the buttocks should include an up-curved surface forward of the ischial tuberosities to allow the forward rotation of the body block while maintaining the primary contact between the ischial tuberosities and the seat pan through the cushions.

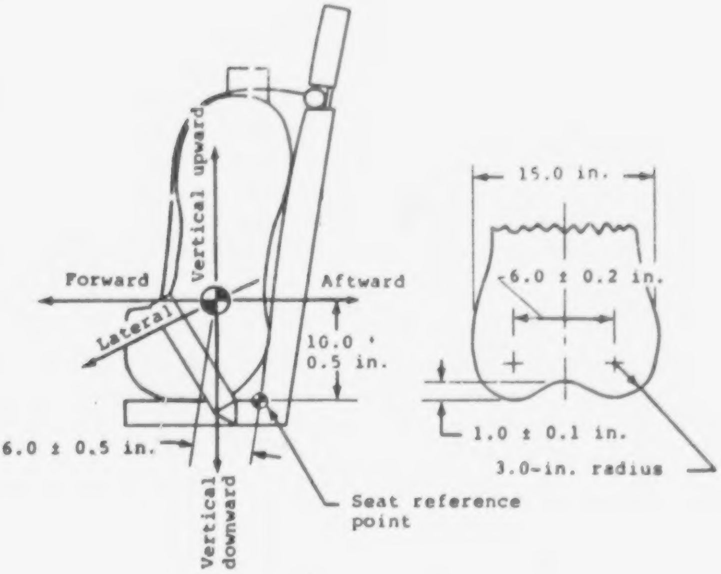

Vertical upward
Forward
Aftward
Lateral
10.0 ±
0.5 in.
6.0 ± 0.5 in.
Vertical downward
Seat reference point
15.0 in.
6.0 ± 0.2 in.
1.0 ± 0.1 in.
3.0-in. radius

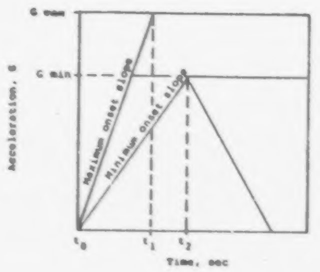
Figure 3. Static load application point and critical body block pelvis geometry.

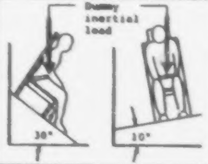
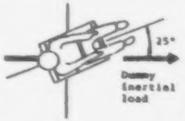
5.2 DYNAMIC TEST REQUIREMENTS

All seats should be dynamically tested to the two conditions specified in Figure 4. Test 1 is required to ensure that the vertical load-limiting provisions will perform satisfactorily under simultaneous forward and lateral loading conditions. Test 2 is required to ensure that the seat can resist the loads produced by the design pulse when applied simultaneously in the forward and lateral directions. A 50th-percentile anthropomorphic dummy complying with the Code of Federal Regulations, Title 49, Part 572 specification for dummies should be used to simulate the seat-system occupant for Test 1. A 95th-percentile anthropomorphic dummy simulating as closely as possible the features of the 50th-percentile dummy described above should be used to simulate the seat occupant for Test 2.

Dynamic testing of multiple-occupancy seats should be performed with the maximum number of occupants specified for the test seat. Additional tests should be run if it is determined that the most adverse loading condition occurs in other than full-occupancy situations. For both tests of Figure 4, adjustable (pilot) seats should be adjusted to the full-aft and up position of the adjustment range. Plastic deformation of the seat is permissible; however, structural integrity must be maintained in all tests. For Test 1, the seat should limit the acceleration as measured in the pelvis of the dummy to values which ensure that the occupant will not experience vertical, $+G_z$, accelerations in excess of human tolerance as defined in Figure 5. The roll direction (10 degrees right or left) for Test 1 should be the more critical loading for the specific seat design.

If load-limiting is used to meet the strength requirements in retrofit applications, the dynamic tests illustrated in Figure 6 should be substituted for the forward, lateral, and downward loading static tests. The downward loading dynamic test utilizes a 50th-percentile dummy; the others, a 95th-percentile device.



Test	Configuration	Parameter	A. Small (Less than 50 Passengers)	B. Medium[a] (50-249 Passengers)	C. Large[b] (250 or more Passengers)
1		t_1 t_2 sec G min G max Δv min, ft/sec	0.109 0.147 19 22[c] 50	0.120 0.160 17 20 50	0.155 0.175 14 18 58
2		t_1 t_2 sec G min G max Δv min, ft/sec	0.109 0.147 19 22 50	0.122 0.138 17 20 58	0.155 0.175 14 16 58

(a) Any aircraft possessing less than a 36-in. depth of fuselage structure below the floor must meet requirements of Category A (small).

(b) Any aircraft possessing less than a 60-in. depth but at least 36 in. of fuselage structure below the floor must meet requirements of Category B (medium).

(c) Energy-absorbing stroke is required, as explained in Section 6.1. Occupant weight for downward loading of Category A seat should be 136 lb.

Figure 4. Dynamic test requirements for qualification and for research/development testing.

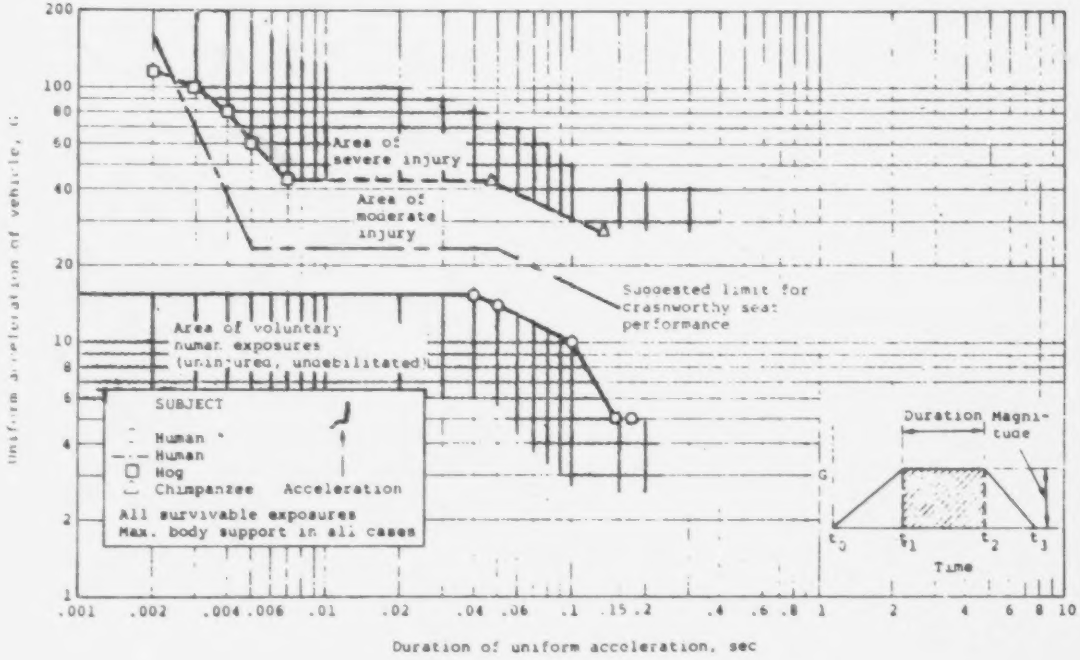
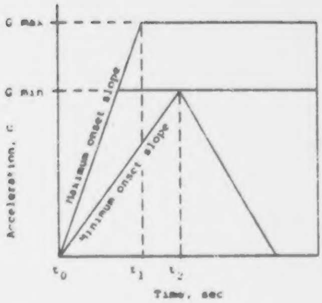
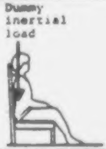
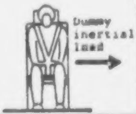
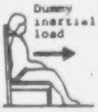


Figure 5. Duration and magnitude of loadward acceleration endured by various subjects.



Test	Configuration	Parameter	A. Small (Less than 50 Passengers)	B. Medium[a] (50-249 Passengers)	C. Large[b] (250 or more Passengers)
1		t_1 sec	0.092	0.157	0.196
		t_2 sec	0.101	0.168	0.201
		G min	17	10	8
		G max	20[c]	12	10
		Δv min, ft/sec	36	36	36
2		t_1 sec	0.091	0.109	0.136
		t_2 sec	0.100	0.116	0.140
		G min	12	10	8
		G max	14	12	10
		Δv min, ft/sec	25	25	25
3		t_1 sec	0.109	0.128	0.155
		t_2 sec	0.122	0.140	0.175
		G min	20	17	14
		G max	23	20	16
		Δv min, ft/sec	50	50	50

(a) Any aircraft possessing less than a 36-in. depth of fuselage structure below the floor must meet requirements of Category A (small).

(b) Any aircraft possessing less than a 60-in. depth but at least 36 in. of fuselage structure below the floor must meet requirements of Category B (medium).

(c) Energy-absorbing stroke is required, as explained in Section 4.1. Occupant weight for downward loading of Category A seat should be 136 lb.

Figure 6. Requirements of additional dynamic tests if substituted for static tests.

APPENDIX B.

The velocity change indicated in Figures 4 and 6 is based on the results of a crash test of a DC-7 transport into an 8-degree slope at an impact speed of 160 mph. The velocity change measured in this impact was 48 ft/sec (approximately 50 ft/sec), as presented in TR 67-16. The fuselage remained intact during this impact with the exception that a propeller blade penetrated the forward fuselage. Estimates in the U.S. Army's Crash Survival Design Guide, TR 71-22, showed a 95th-percentile survivable accident of fixed-wing transport aircraft to have a longitudinal velocity change of 64 ft/sec. However, other observations in survivable crashes, since this report was first published in 1965, indicate that conditions may be too severe. Therefore, the required test velocity change, which controls energy content, has been reduced to approximately that actually measured for the DC-7 test.

APPENDIX TABLE 1

ACCIDENTS/INCIDENTS MEETING CRITERIA

Date Mo-Yr	Aircraft Make and Model	Total Persons Aboard	Injuries				Fire After Impact	Phase of Operation	Airport Proximity	Accident Type
			Fatal	Serious	Minor	None				
1-70	DC-9	61	0	0	0	61	No	Approach	On	Collision with Obstacle
6-70	DC-8	[illegible]	23	11	0	23	No	Landing	>5	Engine Failure or Malfunction
7-70	B-727	[illegible]	0	1	10	41	No	Takeoff	On	Engine Failure or Malfunction
9-70	DC-8	[illegible]	0	11	[illegible]	[illegible]	No	Landing	On	Hard Landing
11-70	B-747	[illegible]	0	7	[illegible]	[illegible]	No	Climb	>5	Turbulence
11-70	DC-8	[illegible]	47	[illegible]	0	[illegible]	Yes	Takeoff	On	Collision with Obstacle
12-70	B-727	[illegible]	2	11	[illegible]	3	Yes	Landing	On	Hard Landing
1-71	B-707	21	0	0	0	21	No	Descent	>5	Collision with Aircraft
3-71	DC-8	11	0	0	1	10	No	Approach	1–5	Collision with Obstacle
6-71	B-747	[illegible]	0	0	0	[illegible]	No	Takeoff	1–5	Fire or Explosion in Flight
6-71	CV-880	[illegible]	[illegible]	3	0	0	Yes	Approach	On	Collision with Obstacle
6-71	B-707	[illegible]	0	0	4	[illegible]	No	Cruise	>5	Evasive Maneuver
6-71	DC-8	8	0	0	0	8	No	Approach	1–5	Collision with Ground/Water
7-71	B-747	[illegible]	0	10	[illegible]	[illegible]	No	Takeoff	On	Collision with Obstacle
8-71	B-707	[illegible]	0	0	0	[illegible]	No	Approach	On	Collision with Aircraft
10-71	DC-8	27	0	0	0	27	No	Approach	On	Collision with Aircraft
1-72	B-747	[illegible]	0	0	[illegible]	[illegible]	No	Cruise	>5	Turbulence
3-72	FH-227	[illegible]	[illegible]	[illegible]	0	0	No	Approach	1–5	Propeller Failure
4-72	B-747	[illegible]	0	2	12	[illegible]	No	Cruise	>5	Turbulence
4-72	B-727	[illegible]	0	0	2	[illegible]	No	Descent	>5	Evasive Maneuver
6-72	DC-9	10	0	3	0	7	Yes	Landing	On	Collision with Ground/Water
6-72	DC-10	67	0	0	11	[illegible]	No	Climb	>5	Airframe Failure
8-72	B-707	[illegible]	0	0	[illegible]	[illegible]	Yes	Takeoff	On	Collision with Obstacle
10-72	B-727	[illegible]	[illegible]	12	2	4	Yes	Approach	1–5	Stall/Mush
12-72	DC-9	[illegible]	10	0	0	21	Yes	Takeoff	On	Collision with Aircraft
12-72	CV-880	[illegible]	0	0	2	[illegible]	No	Taxi	On	Collision with Aircraft
12-72	L-1011	176	[illegible]	[illegible]	17	0	No	Approach	>5	Collision with Ground/Water
12-72	B-747	[illegible]	0	0	4	[illegible]	No	Landing	On	Engine Failure or Malfunction
4-73	B-727	37	0	0	0	37	No	Approach	1–5	Collision with Obstacle
6-73	DC-8	[illegible]	0	3	[illegible]	[illegible]	Yes	Takeoff	On	Airframe Failure
8-73	DC-8	[illegible]	0	0	0	[illegible]	Yes	Landing	On	Undershoot
7-73	FH-227	[illegible]	[illegible]	0	0	0	Yes	Approach	1–5	Collision with Ground/Water
8-73	B-707	[illegible]	1	3	1	[illegible]	No	Descent	>5	Miscellaneous
10-73	B-727	[illegible]	0	0	5	[illegible]	Yes	Landing	On	Overshoot
11-73	DC-10	[illegible]	1	0	[illegible]	[illegible]	No	Cruise	>5	Engine Failure or Malfunction
11-73	DC-9	[illegible]	0	4	[illegible]	37	Yes	Approach	On	Undershoot
11-73	DC-9	[illegible]	0	[illegible]	[illegible]	0	No	Landing	On	Overshoot
12-73	DC-10	[illegible]	0	3	13	[illegible]	Yes	Landing	On	Undershoot
1-74	B-707	[illegible]	0	2	0	[illegible]	Yes	Landing	On	Hard Landing
1-74	B-707	101	[illegible]	5	0	0	Yes	Landing	On	Undershoot
5-74	B-707	111	0	3	12	[illegible]	No	Cruise	>5	Turbulence
7-74	DC-10	172	0	0	0	172	No	Climb	>5	Airframe Failure
9-74	DC-9	82	71	10	0	0	Yes	Approach	1–5	Collision with Ground/Water
3-75	B-727	[illegible]	0	1	3	[illegible]	No	Landing	On	Overshoot
6-75	B-727	124	112	12	0	0	Yes	Approach	On	Undershoot
8-75	B-727	[illegible]	0	[illegible]	0	[illegible]	No	Takeoff	On	Collision with Ground/Water
8-75	DC-10	[illegible]	0	3	[illegible]	[illegible]	Yes	Takeoff	On	Airframe Failure
8-75	F-27B	32	[illegible]	[illegible]	2	0	Yes	Approach	On	Collision with Ground/Water
11-75	B-707	[illegible]	0	1	7	131	No	Landing	On	Undershoot
11-75	DC-10	139	0	2	30	107	Yes	Takeoff	On	Engine Failure or Malfunction
11-75	DC-10	[illegible]	0	3	21	[illegible]	No	Cruise	>5	Evasive Maneuver
12-75	B-747	121	0	2	0	119	No	Taxi	On	Ground-Water Loop-Swerve
4-76	DC-9	[illegible]	0	0	0	[illegible]	No	Approach	On	Evasive Maneuver
4-76	B-727	[illegible]	1	11	23	[illegible]	Yes	Landing	On	Overshoot
4-76	B-727	[illegible]	37	[illegible]	[illegible]	3	Yes	Landing	On	Overshoot
6-76	L-188	45	[illegible]	0	0	0	Yes	Takeoff	On	Engine Failure or Malfunction
6-76	DC-8	[illegible]	0	[illegible]	0	[illegible]	No	Approach	On	Collision with Ground/Water
11-76	DC-9	[illegible]	0	2	[illegible]	[illegible]	Yes	Takeoff	On	Collision with Obstacle
4-77	DC-9	[illegible]	[illegible]	22	1	0	Yes	Cruise	>5	Engine Failure or Malfunction
6-77	B-727	[illegible]	0	0	0	[illegible]	No	Takeoff	On	Collision with Obstacle
3-78	DC-10	200	2	[illegible]	[illegible]	113	Yes	Takeoff	On	Airframe Failure
6-78	B-727	[illegible]	3	11	21	23	No	Approach	1-5	Collision with Ground/Water
6-78	DC-8	–	0	0	0	–	No	Takeoff	On	Evasive Maneuver
7-78	BAC 1-11	[illegible]	0	1	0	[illegible]	No	Landing	On	Overshoot
7-78	CV-880	[illegible]	0	3	[illegible]	[illegible]	No	Takeoff	1–5	Engine Failure or Malfunction
10-78	B-727	[illegible]	0	4	3	103	No	Static	On	Miscellaneous
11-78	DC-9	[illegible]	0	0	0	[illegible]	No	Takeoff	On	Stall/Mush
12-78	DC-8	[illegible]	10	23	[illegible]	[illegible]	No	Approach	>5	Engine Failure or Malfunction
3-79	[illegible]	[illegible]	2	0	[illegible]	0	No	Takeoff	On	Collision with Ground/Water
3-79	B-727	[illegible]	0	0	0	[illegible]	No	Taxi	On	Collision with Aircraft
3-79	B-747	[illegible]	0	0	0	[illegible]	No	Landing	On	Collision with Aircraft
3-79	[illegible]	7	3	0	0	4	No	Takeoff	1–5	Engine Failure or Malfunction
4-79	B-727	[illegible]	0	0	0	[illegible]	No	Cruise	>5	Uncontrolled Altitude Deviation
6-79	B-707	77	0	0	0	77	No	Approach	1–5	Turbulence
8-79	DC-9	45	0	0	1	44	No	Climb	>5	Airframe Failure
11-79	DC-10	[illegible]	0	0	0	[illegible]	No	Climb	>5	Stall/Mush
3-80	DC-9	[illegible]	0	1	[illegible]	27	No	Landing	>5	Overshoot
3-80	DC-9	[illegible]	0	0	7	45	No	Cruise	>5	Airframe Failure
3-81	B-707	111	0	3	[illegible]	77	Yes	Landing	On	Gear Retracted

APPENDIX TABLE 2

ACCIDENTS/INCIDENTS WITH FAILURES

RESCUE AND FIRE COMMITTEE

A. COMMITTEE POSITION PAPERS

B. ASSOCIATION POLICY

COMMITTEE POSITION: No. 1

RECOMMENDATIONS CONCERNING AIRPORT CRASH FIRE-FIGHTING VEHICLES

The Rescue and Fire Committee agrees with the vehicle requirements as set forth in National Fire Protection Specification (NFPA) publication 414 (Aircraft Rescue and Fire Fighting Vehicles 1975) and ICAO publication 913-AN/968 Airport Services Manual Part 1 (1977) with the following exceptions:

1. All vehicles including RIVs (Rapid Intervention Vehicles) must be equipped with roof-mounted turrets operable from the cab.
2. ICAO airports in categories 8 and 9 (widebodies/DC8-61) should be equipped with a minimum of three major CFR vehicles.
3. Top speed requirement for major and intermediate CFR vehicles should be increased tc 65 mph.
4. Turret discharge capability (range) for major vehicles should be increased to 250-300 ft., intermediate vehicle range should be increased to 200-300 ft., and RIV range should be increased to 150-200 ft.
5. Acceleration rate for major vehicles should be increased to 0-50 mph in 40 seconds or less.

The Committee's vehicle design recommendations are as follows:

	MAJOR CFR UNIT 2500 gallons (U.S.) and up	INTERMEDIATE UNIT 1500 gallons (U.S.)	RAPID INTERVENTION UNIT
Water for Foam Production	2500 gal. +	1500 gal. +	500 gal. minimum 1,000 gal. maximum
Other Agents (Recommended minimums)	none	none	500# dry powder and/ or 350# Halon 1200
Roof-Mounted Turret Required	yes	yes	yes
Turret Capacity	1500 + GPM	750 + GPM	500 + GPM
Discharge Range	250-300 ft.	200-250 ft.	150-200 ft.
Single Operator Capability	yes	yes	yes
Handlines	two	two	one
Engine Mounting	rear	rear	rear
Transmission	automatic	automatic	automatic
Acceleration 0-50	40 sec. or less	30 sec. or less	20 sec. or less
Top Speed	65 MPH	65 MPH	75 MPH

ICAO AIRPORT CATEGORY	RAPID INTERVENTION VEHICLE	MAJOR VEHICLE
1	1	0
2	1	0
3	1	0
4	1	1
5	1	1
6	1	2
7	1	2
8	1	2
9/10	1	3

All vehicles must be capable of pump engagement and operation while the vehicle is in motion and must be radio-equipped for communication with both the aircraft and ground emergency services. Test equipment should be installed for the purpose of quickly checking serviceability of the agent discharge system; malfunction warning lights should be placed at the driver's position.

Special Terrain Vehicles

Whenever airports are located in areas surrounded by terrain (mud flats, swamps, etc.) which cannot be negotiated by standard vehicles, special equipment shall be provided which will be able to respond to areas beyond the runway safety area in minimum time. Air cushion vehicles, air boats, or tracked vehicles may be required.

COMMITTEE POSITION: No. 2

AIRPORT CRASH RESPONSE CAPABILITY

Review of aircraft accident statistics will demonstrate that most aircraft crashes occur on or near airports rather than during enroute portions of flight operations. In fact, ICAO statistics published in 1976 show that:

> 91% of aircraft accidents are on or in the approach/departure zones of airports.
>
> 71% of aircraft accident deaths are caused by fire.
>
> 35% of aircraft fire deaths occur in overrun/underrun zones.
>
> 45% of aircraft accident deaths occurring in overrun/underrun zones were caused by fire.

These figures serve to illustrate the critical nature of fire response capability of an airport fire department. Without aircraft having effective means of preventing post-crash fire installed on board, the only protection that can be offered to aircraft occupants is rapid and effective fire extinguishment by crash, fire and rescue (CFR) units stationed on the airport and capable of instant response. Unlike typical structural or building fires, aircraft fires can develop into lethal proportions within seconds and eliminate any possibility of occupant escape. Thus, the matter of CFR response times and capability becomes much more critical than is the case in structural fires.

If highly trained CFR units can arrive at the crash site in minimum time and apply massive amounts of fire extinguishing agents, a post-crash fire can be extinguished or controlled to the point that cabin evacuation will be successful. This was well illustrated by the response of the Los Angeles International Airport Fire Department after the crash of a DC-10 in 1978. That only two fatalities occurred can be laid to immediate CFR response.

The only acceptable standards for CFR in the United States are contained in ICAO Annex 14, FAR Part 139 and NFPA 402/403. Both ICAO and FAA recommendations contain exceptions based on financial considerations which result in a dangerous reduction in the standard of protection. This Committee, therefore, endorses only the recommendations of the National Fire Protection Association, as well as the following:

1. For each airport there should be established a "Critical CFR Access Area" which should be defined as an area above a runway, 1,000 feet in width, and extending 3,000 feet beyond the ends of the runway. This CFR Access Area would have adequate all-weather access roads and terrain would be cleared or leveled so that CFR vehicles could respond to an accident in this area within a time not to exceed three minutes in all conditions of weather and visibility while aircraft are able to operate. Minimum response time to the ends of the runway should be no more than two minutes.

2. The amount of fire extinguishing agent to be required for any given airport should be determined by the size of the largest aircraft normally operating from the airports and not by a factor based upon number of flight operations per year.

3. All airport fire equipment should meet the standards suggested in the FAA Advisory Circular 5210-6B, both for the total amount of equipment and its capabilities. If protection is reduced below this level due to equipment maintenance, manpower reductions, etc., the minimum protection permissible should not be less than one category lower.

4. All airport fire trucks should be equipped with turrets for discharge of fire-fighting agent. These turrets may be operated from both inside and outside the vehicle cab; however, they must be operable from inside the cab at a minimum. Handlines should not be considered primary fire-fighting equipment.

5. All crash trucks should be manned by a minimum of one driver and an operator for each turret and at least one handline; however, in an emergency the vehicle should be capable of maneuvering and turret operated with one operator in the cab. If it is planned to operate the vehicle with only one driver/operator as a routine procedure, then the vehicle should contain at least 25% additional agent to account for wastage. It is also necessary for extinguishing agent discharge system malfunction warning lights to be located at the driver's position.

6. At airports where adverse terrain conditions exist, specialized CFR vehicles should be maintained for use on such terrain (mud flats, swamps, etc.).

7. In comparison with the conventional large airport fire trucks, rapid intervention vehicles (RIVs) can be extremely effective due to their speed, size and mobility. (RIVs should be deployed as primary fire-fighting vehicles.)

8. All emergency vehicles should be equipped with a VHF radio in order to establish direct communication, when necessary, with the control tower and the aircraft flight crew.

9. In the event of an aircraft accident, the airport manager and/or the FAA Air Traffic Control Facility shall immediately suspend aircraft movements until such times as all emergency vehicles can respond without hindrance and the security of the operational area has been determined.

10. Fire equipment shall be so located that it can respond to any portion of active runway in 2 minutes or less. In order to accomplish this requirement, the following may be required:

a. One or more satellite firehouses fully manned.
b. A satellite firehouse manned only when the runway is in use (strong winds or closing of the main runway).

11. The firehouse shall be so located adjacent to the runway, and access roads provided, in order for the emergency vehicles to utilize their full acceleration and top speed capability while responding to an emergency.

12. At small airports with limited air carrier operations where no firehouse is maintained, it is mandatory that the CFR vehicle(s) stand by the active runway during any air carrier movement (landing or takeoff).

13. Airport fire and rescue personnel should be primarily employed as airport fire fighters and should be fully trained in the specialized field of aircraft fire and rescue operations. Handline operators and rescue personnel/emergency medical technicians (EMTs) could be used for other duties such as airport security, so long as they may be transported within three minutes from their place of duty to any crash site within the CFR access area. Drivers and turret operators should remain with their vehicles at all times during duty hours. At airports where volunteer airport fire fighters are utilized, drivers and turret operators should remain with their vehicles at all times scheduled flight operations are in progress.

14. Each shift of CFR personnel should contain at least two qualified EMTs or paramedics and should be dual-qualified as both fire fighters and EMT/paramedics. Medical supplies and ambulances should be available to permit response to aircraft accidents and airport medical emergencies involving passengers, visitors, and employees. Where ambulances cannot be provided on the airport, it is recommended that they be available within a five minute radius of the airport.

15. Other than contained in NFPA Guideline 1003, there is no accepted national standard for airport fire fighters in the United States; all training is now accomplished by local authorities. A few short-course regional schools run by various local interests are available; however, the quality of training is far below accepted standards.

It is therefore recommended:

a. That a national airport fire fighter school be established by the National Fire Academy similar to the U.K. CAA Fire School at Stanstead.
b. That all airport fire fighters be certificated and rechecked annually.
c. That all airports hold hot drills at least on a quarterly basis.
d. That the above requirements be made a regulation under Part 139.

16. Extinguishing agent quantities are based on the potential fire area to be protected - determined to be the width of the fuselage plus 100 ft. times the overall fuselage length. NFPA 403, ICAO Annex 24, FAR Part 139 and FAA AC5210-6B determine agent quantity by subdividing aircraft into a number of categories determined by overall length. In all cases the top two categories are based on the fuselage width of a wide-body aircraft (20 ft.) and the lower categories on the width of a narrow-body aircraft (10 ft.).

Wide-body aircraft are now being constructed whose overall length is below the top two categories and are therefore underprotected.

All wide-body aircraft whose overall length is below the top two categories shall be considered as falling into the next higher category for purposes of providing adequate airport crash fire protection.

COMMITTEE POSITION: No. 3

PROVISION FOR CRASH, FIRE AND RESCUE (CFR) SERVICES DURING ADVERSE WEATHER CONDITIONS

Since the majority of air carrier accidents occur on or near the active runway (reference Figure 2, p. 12), the ALPA Rescue and Fire Committee has emphasized that airfield CFR capabilities should be directed toward response to crashes located within the Critical CFR Access Area, an area on and surrounding the runway in use. Minimum response times, for CFR equipment, of two minutes to points on the runway surface and three minutes to points at the extremities of the CFR Access Area are critical to the survival of aircraft occupants involved in a crash. Such a response capability is difficult enough to ensure under field conditions of good visibility and dry pavement or terrain. It is even more difficult, but no less critical, to provide adequate CFR response in adverse weather conditions that obscure visibility on the airfield. Though many current aircraft can routinely operate in weather conditions of zero ceiling and less than 1200 feet visibility, the CFR equipment that must serve these aircraft does not have a similar capability. Recent accidents at Los Angeles International Airport, Chicago's O'Hare Field, Boston's Logan Airport, and Tenerife illustrate the difficulty of carrying out CFR operations when aircraft have crashed on the field and cannot be located due to visual obscuration. To remedy this critical problem, the ALPA Rescue and Fire Committee recommends the following:

1. CFR equipment should be located adjacent to the midpoint of the active runway during Category II and III operations.

2. Air carrier aircraft should be equipped with emergency locator transmitters (ELTs) located on the vertical stabilizer that are designed to be actuated either automatically by crash deceleration forces or manually whenever the flight crew wishes to indicate a developing emergency.

    a. ELTs should be powered independently of the aircraft's normal electrical system and should be capable of twelve hours' operation under adverse weather conditions.

    b. Strobe (condenser discharge) lights should be incorporated into ELTs to provide CFR crews a visual identification and location capability at crash sites that supplements the locating aid of the electronic homing beacon.

    c. Such ELTs should be of waterproof construction and capable of operation while totally submerged in order to provide rapid sonar location in the event of an offshore ditching.

    In addition to facilitating CFR operations on or near an airfield, such ELTs would aid in wreckage location in remote geographic areas.

3. CFR vehicles should be equipped with direction-finding devices capable of homing on activated ELTs and providing guidance to a crash site in conditions of reduced visibility.

4. Major hub airports should be provided with Airport Surface Detection Radar (ASDE) that will enable the control tower to locate an on-field crash and direct emergency equipment to the site.

COMMITTEE POSITION: No. 4

RUNWAY FOAMING PROCEDURES

It is recommended that runway foaming be required only for accidents or potential accidents involving propeller-driven aircraft and for potential accidents involving a malfunctioning nose-wheel system.

It has long been the practice throughout the world to lay a foam blanket on a runway to be used by an aircraft experiencing landing-gear difficulties. Let us examine some of the reasoning behind this concept. It was at first thought that use of a protein foam blanket would enable an aircraft to slide down the runway without causing serious damage to the aircraft skin. This theory was explored by the U.S. Navy, and it was found that there is little or no difference between the coefficient of friction between metal and the runway surface with or without a foam blanket on the runway. A second theory is that use of a foam blanket would cut down friction sparking. The Navy found this theory to be correct under certain circumstances; the foam did reduce spark hazard from such metals as aluminum and many of the steels. However, titanium still produced heavy friction sparking regardless of the depth of the foam blanket.

In the days of the piston-engine aircraft, when a belly landing took place, the propeller often would break away from the engine, usually taking with it the nose casing. The propeller assembly would pass underneath the wing of the airplane and cut a hole in the fuel tank which released aviation gasoline into the immediate area where friction sparks were being produced. This invariably resulted in fire and is the very reason ALPA strongly advocated the use of a foamed runway for all accidents involving propeller-driven aircraft. On impact, of course, the piston engine itself usually came to an abrupt stop and the only ignition sources that remained were the hot cylinders and exhausts. Quite frequently, plowing through the foam would aid in reducing the ignition hazard from these hot sections.

Differing characteristics of jet aircraft change the situation described above, since there is no propeller to break away from the engine. Little or no damage is sustained in a belly landing other than scraping of the fuselage skin, and there is usually no fuel spillage unless an engine breaks off at the pylon. Friction sparking is still an ignition source; but now, with the jet engine, the entire powerplant is a hot-section ignition source. A turbojet engine does not cease to rotate on impact — in fact, it will keep rotating up to five minutes. There have been innumerable cases where the engine has been thrown clear of the aircraft altogether and still continued to rotate, drawing in fuel vapors and igniting them. In most jet engines, there is sufficient residual heat in the engine hot-section to ignite fuel vapors for up to 20 minutes after shutdown. It can therefore be seen that friction sparking is a relatively minor ignition source in jet aircraft when compared to the jet engine itself. The same theory holds true even with those engines mounted in the rear fuselage section.

Though runway foaming does not appear to be productive when considering ignition suppression, to fully consider use of foam on runways one must look at problems involved with a cocked or malfunctioning nose gear. It was stated earlier that there was no difference in the coefficient of friction of metal and the runway surface for a dry or foamed runway. This does not hold true for the friction coefficient of rubber and a runway surface. As anyone who has had any boating experience knows, rubber slides very easily on water. All pilots know this; they can make smoother landings when the runway is wet than when it is dry. In fact, many aircraft have run off the end of the runway because of inadequate braking caused by wet-weather conditions. When a nose wheel is cocked, this means that the wheel is not aligned with the runway and/or direction of motion of the aircraft; if protection is not provided, the nose gear will either break off or will direct the airplane off the runway, thereby causing serious structural damage. Therefore, it is necessary to provide a wet surface to allow the wheel to slide. This can best be done by applying water in adequate amounts to the runway, and the best way to apply and retain this water on the center line is in the form of protein foam. It is recommended that a narrow strip of foam, approximately half the width of the gear of the aircraft involved, be laid on the runway center line. This will allow the nose wheel to slide along in the foam and leave the main gear on the dry pavement to provide adequate braking action for stopping the aircraft as soon as possible.

It is also recommended that a narrow strip of foam be laid in case the nose wheel should fail to extend. A malfunction of the nose wheel often results in the spillage of hydraulic fluids, and there have been cases on record of friction sparks igniting this hydraulic fluid when the aircraft slides down the runway on its nose. One accident illustrating this point was a TWA Boeing 707 in Los Angeles. In this case, a fire in the nose wheel w ll was not extinguished due to the arrival of the crash fire equipment being delayed by heavy fog conditions. The small fire spread into the oxygen system and eventually gutted the entire fuselage area. Fortunately, the fire spread slowly, and all passengers were safely evacuated long before the fire reached lethal proportions.

If the pilot-in-command prefers to use a foamed runway for any landing gear emergency, National Fire Protection Association Manual 402, Part 1140 should be referred to for guidance. Regardless of the circumstances, it is recommended that runway foaming be used only when there is adequate time for all Crash Fire Rescue equipment to be completely replenished prior to the landing being made. The distinction must be made that protein foam and AFFF (light water) agent differ in their fire-fighting uses. Since AFFF is more efficient at fire knockdown than protein foam, AFFF has become the common agent for CFR use; however, it does not act as a water-retaining "blanket" and cannot be used for runway foaming. Therefore, the pilot-in-command should not request runway foaming if AFFF is the CFR agent in use.

COMMITTEE POSITION: No. 5

WATER RESCUE (AIRPORTS)

Because accidents involving water rescue and occurring adjacent to airports happen without warning and occupants are unprepared for a water evacuation, it is mandatory that aircraft be equipped with at least limited-range overwater survival equipment. Since many aircraft are not so equipped, the airport authority must be capable of rapid response for water rescue purposes. Each airport should maintain:

1. At least one turbine-powered rescue boat carrying inflatable rafts capable of holding the total number of occupants of the largest aircraft regularly scheduled into the airport.
2. Ideally, the boat(s) shall be located at a joint fire/boathouse if adjacent to the water's edge; if not, there must be a separate boathouse with a direct access road to the firehouse. Note: Land response remains the primary concern because of fire.

WATER RESCUE (MID-OCEAN)

There are still worldwide problems involving mid-ocean emergency communication capability.

It is recommended that the Coast Guard sponsor a worldwide satellite VHF communications network and that all commercial aircraft and shipping monitor the emergency frequency (121.5).

COMMITTEE POSITION: No. 6

AIRPORT RUNWAY SAFETY AREAS

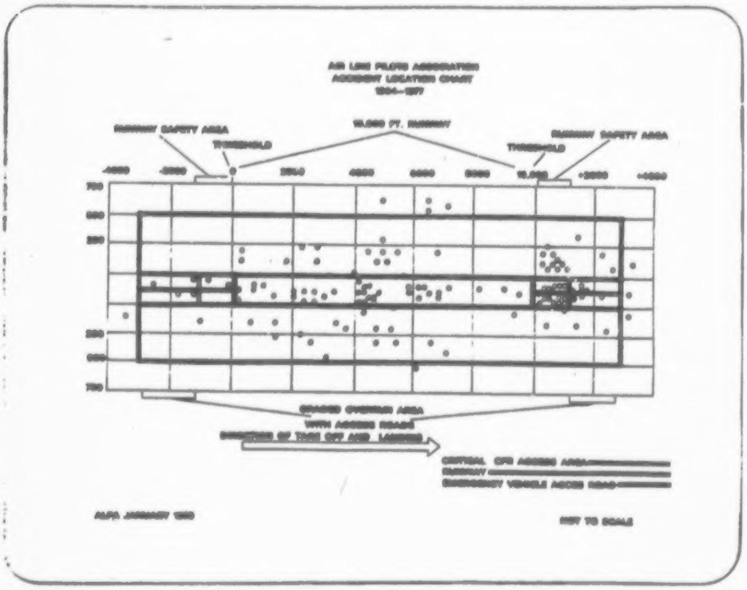


Fig. 2 - Accident Location Chart

Eighty percent of all air carrier accidents occur on or within 3000 ft. of the active runway, the majority at the approach ends (Fig. 1). Most of these accidents are survivable. However, obstructions in the overrun areas frequently cause structural damage to the aircraft and injury to the occupants and impede access of the emergency equipment (Fig. 3).

It is therefore recommended that all runway overrun areas be cleared of obstructions and graded for a distance of 3000 ft. from the threshold (Fig. 4).

a. Where ditches exist, these shall be covered or, if not possible, the banks graded to allow aircraft and vehicles to cross without damage. Water depth shall be limited to 30 inches and the bed hard-surfaced.

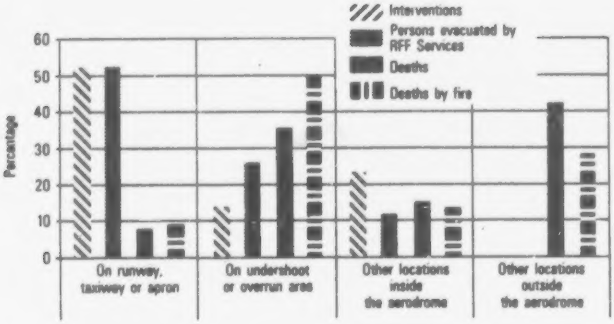


Figure 3

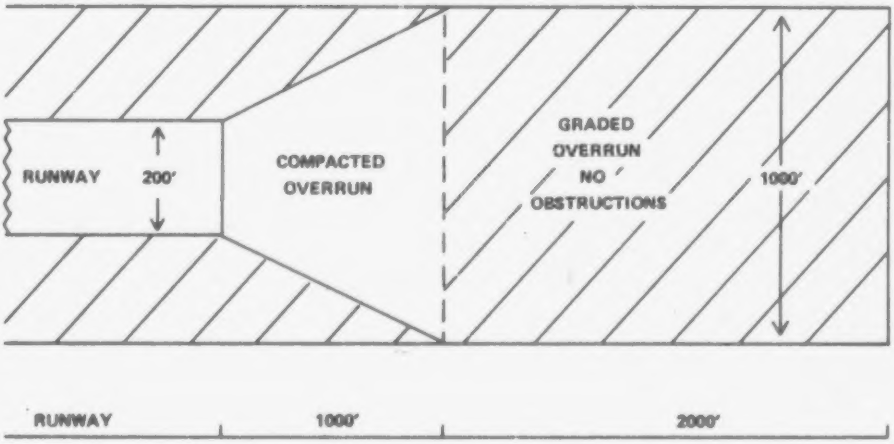

RUNWAY OVERRUN AREAS
RUNWAY
200'
COMPACTED OVERRUN
GRADED OVERRUN NO OBSTRUCTIONS
1000'
RUNWAY
1000'
2000'

Figure 4

b. All railroad lines shall be constructed as grade crossings.

c. All fences must be frangible.

d. All approach lights must be frangible.

e. All instrument landing aid facilities shall be frangible.

f. An all-weather, two-lane access road must be constructed for the length of the area.

g. All other roads must be routed around the area or, if depressed below surface level, must be bridged.

h. Where a runway safety area terminates at the water's edge, the surface must be graded and/or paved into the water in the manner of a seaplane ramp; sea walls are not suitable, as these break up the fuselage in the event of an under- or overshoot.

COMMITTEE POSITION: No. 7

COMPREHENSIVE EMERGENCY PLANNING FOR AIRPORTS

The characteristic unexpectedness and severity of aircraft accidents, as well as the fact that the majority of transport aircraft accidents occur on or near the runway in use, make it vital that airport operators provide comprehensive plans for airport/community response. Preplanning and practice will result in efficient handling of actual emergencies and go far toward minimizing injury and loss of life. Effective, coordinated emergency plans will be of benefit not only to airports, but to the entire community; they are readily adaptable to any emergency circumstance. Indeed, it is common for airports to serve as the focus of relief efforts during disasters.

The successes and failures noted during recent disaster plan exercises throughout the country have led the Rescue and Fire Committee to make the following recommendations:

Emergency Planning: All air carrier airports should draft emergency response plans based upon National Fire Protection Association (NFPA) guidelines to include provision of emergency medical personnel and facilities, designated command and control mechanisms, and casualty treatment and evacuation systems. During aircraft accident investigations conducted by the NTSB and FAA, the airport/community emergency plan should be evaluated for:

a. Response of CFR equipment and personnel.
b. Success of security measures.
c. Medical response.
d. Air carrier response in accordance with the carrier's plan and the local airport/community plan.
e. Functioning of any communications network.
f. Effectiveness of command and control efforts.
g. Community mutual aid and organizational cooperation.

Exercises: Airport emergency plans, already required by FAR 139 for air carrier airports, should be exercised annually by full-scale disaster drills. There is currently no such requirement for testing of emergency plans; thus only the more progressive airport operators have carried out these drills.

Medical Capability: Each air carrier airport having 3,000 or more employees and/or two million passengers per year should establish 24-hour emergency ambulance service, paramedic crews, and a clinic staffed by either physicians, physician's assistants, paramedics, nurses or emergency medical technicians (EMTs). Mini-ambulances should be provided for use inside medium and large hub terminal buildings and should be equipped to deal with cardiac emergencies.

Each airport should have two airport fire fighters per shift trained as paramedics or EMTs, direct voice links between airport paramedics, EMTs, etc., and hospital emergency rooms. Smaller airports should have at least one fully equipped ambulance based adjacent to or on the airport and capable of responding to an airport emergency within five minutes. Adequate portable emergency medical supplies, e.g., medicines, backboards, stretchers, bandages, blankets, etc., should be stocked in designated storage areas. Additionally, all public contact airline employees should be trained in cardiopulmonary resuscitation (CPR), mouth-to-mouth resuscitation, and the "Heimlich maneuver."

Command and Control: Each airport should maintain a mobile, highly visible, identifiable command post equipped with adequate emergency communication facilities and able to communicate with fire, police, and medical agencies involved. There should be a designated "airport medical coordinator" who is responsible for all medical functions and procedures at the airport. Grid maps of the airport and surrounding community should be provided for all affected emergency agencies and should highlight all medical facilities (with description of services available), helicopter pads, and emergency access routes between the airport and these medical facilities. There should be, on hand, sufficient barricades and several 200-foot lengths of rope to cordon off accident areas. Emergency telephone lists should be compiled and updated monthly by use of communication mini-drills among participant agencies. On-site identification of emergency agency representatives should be provided by use of vests indicating the wearer's function. Front and rear reflective lettering should be used, e.g.:

Fire - Red vest with the words "FIRE CHIEF"

Security - Blue vest with the words "POLICE CHIEF"

Medical - White vest with the words "MEDICAL COORDINATOR"

Airport Operations - International orange with the words "OPERATIONS CHIEF"

Safety Organizations - Green vest with organization initials (FAA, NTSB, etc.)

Casualty Treatment: Plans should be adequate to cope with the emergencies involving a full passenger load of the largest aircraft scheduled into the airport. Color-coded identification tags should be stocked sufficient for the passenger capacity of the largest aircraft certified to land at the airport. Adequate supplies of body bags should be available from civil or military sources. There should be a designated holding area for all uninjured survivors, and it should have adequate toilet and drinking water facilities. Shelters such as tents, hangars, terminal areas, etc., should be provided to protect survivors from the elements and curiosity seekers.

COMMITTEE POSITION: No. 8

AIR CARRIER AIRCRAFT STRUCTURAL INTEGRITY

Since the introduction of large jet aircraft, there has been a relative increase in the injury and fatality rate during survivable accidents. This is caused, to a great degree, by cabin interior furnishings which break loose at relatively low impact loads and injure the occupants or trap them and thereby prevent their escape in the event of fire.

According to the U.S. Air Force design guide specifications, human tolerance limits are as follows:

Upward	25 G
Forward	45 G for 0.1 Sec. or 25 G for 0.2 Sec.
Sideward	9 G (11.5 with shoulder harness)
Downward	15 G
Rearward	45 G (for 0.1 Sec.)

In contrast, present FAA requirements for Transport Category Aircraft (FAR 25.561) specifies the following as crash load design goals:

Upward	2 G
Forward	9 G
Sideward	1.5 G
Downward	4.5 G

Further, it has also been determined that fuselage fuel tanks may be designed to meet the same low G forces as other cabin interior furnishings (FAR 25-963(d)).

These fuel tanks are now carried in baggage compartments on some extended-range aircraft and therefore present a particularly hazardous situation in the event of an accident since any spilled fuel underneath the cabin floor, when ignited, provides an almost instantaneous lethal environment in the cabin due to heat and toxic gases.

In 1969, the FAA issued NPRM 69-33, which was later withdrawn, to upgrade crashworthiness requirements. The FAA Office of Aviation Medicine recommended these minimum limits:

Upward	20 G
Forward	20 G
Sideward	10 G
Downward	20 G
Rearward	20 G

The Flight Safety Foundation recommended the following:

Horizontal	20-25 G	
Vertical	15-20 G	Time duration 0.2 - 0.3 seconds
Lateral	10-15 G	

Research by both the automotive and aircraft industry has shown that new seat design, energy absorption devices and new materials can be combined to provide greater impact protection without causing a significant weight penalty (1 lb. in weight averages 15 gal. fuel per year, per aircraft).

The ALPA Rescue and Fire Committee, based on the above data (AGARD Report AG-221, R. G. Snyder), therefore recommends that the FAA immediately institute a new NPRM to require upgrading of FARs 25.561 and 25.963(d) and thus require all cabin interior fittings, including galleys, coat closets and fuel tanks, be able to withstand impact forces of:

Longitudinal	20 G
Vertical	20 G
Lateral	10 G

The committee further recommends that all seats be dynamically tested to withstand human "G"-tolerance limitations. Flight deck seats should be tested using the standard seat belt/shoulder harness restraint system; this 5-point system is instrumental in increasing survivable impact forces.

COMMITTEE POSITION: No. 9

CRASHWORTHY FUEL SYSTEMS

Construction improvements in transport aircraft in the last two decades have brought about a generation of air carrier aircraft that are not only faster than piston-powered predecessors but stronger and safer. Today, an aircraft accident is normally a survivable occurrence, since the airframe is now capable of remaining relatively intact under crash impact. Ironically, though, the benefits of strengthened airframes are often cancelled by the effect of a post-crash fire; it is increasingly possible for passengers and crew members to survive the crash, yet still perish in the ensuing flames.

Programs to prevent the occurrence or minimize the severity of post-crash fires should reflect an appreciation of the crash fire profile. Studies carried out by the International Civil Aviation Organization (ICAO), the British government, and ALPA showed that 75% to 85% of aircraft crashes occur in the vicinity of airports and are associated with either takeoff or landing portions of flight operations. In these accidents, the aircraft impacts the ground under reasonably controlled circumstances and sustains impact loads that are survivable — as opposed to the minority of accidents which occur enroute and are normally true high-speed catastrophic occurrences. Fire is the predominant hazard in the typical accident occurring near an airfield as may be seen in ICAO figures comparing fatalities to crash locations. While 57% of all crash fatalities occur in accidents within airfield boundaries, 72% of aircraft fire deaths occur within this same area. Thirty-five percent of all aircraft accident deaths are caused by post-crash fires within airfield boundaries, and most significantly, 48% of all deaths in this same airport area are caused by fire.

By reducing the likelihood of crash fire severity through regulatory action, the FAA can guarantee occupants the critical 2 to 5 minutes that are normally required to evacuate transport aircraft.

The matter of various engineering techniques that may be used to achieve crashworthy fuel systems should be viewed as a variety of complementary techniques to be applied to aircraft construction and operation that will guarantee the highest degree of crash fire safety. At present, ALPA's Rescue and Fire Committee is particularly interested in immediate application of the following three fire-prevention techniques:

Low Volatility Fuel

Proposal: That the appropriate sections of FARs 25 and 121 be amended to require that for turbine-powered aircraft, the fuel must have a flash point not less than 100 degrees fahrenheit.

Explanation and Justification: Information presented at the FAA hearing of June 13, 1977, made it clear that there are significant safety benefits to be derived from the exclusive use of Jet A (kerosene) fuel in turbine-powered aircraft, particularly in accidents involving spillage. Jet A is more difficult to ignite than Jet B; and if ignited, flames propagate at a much slower rate than is true of Jet B, especially at fuel temperatures that normally prevail. These differences can be vitally important in accidents where a short delay in fire development would allow occupants to escape. The material discussed in Coordinating Research Report number 482, and the references listed in that report, thoroughly document the safety advantage of Jet A. The proposed rule amendment should permit adequate time for operators to arrange for the necessary transport, storage, and dispensing equipment at airports where Jet A is not now available.

Vent System Flame Arrestors

Proposal: That FAR 25.975 be amended by adding a new section requiring means of preventing or suppressing flame propagation into fuel tank venting systems when flammable fuel-air mixtures are likely to exist. Such a system must not impair the function of the venting system under the range of climate conditions for which the aircraft is approved.

Explanation and Justification: Vent system outlets are points of exposure of fuel vapors to possible ignition by sparks or ground fires such as can occur if there is fuel spillage or an accident during which a ground fire develops in the vicinity of the vent outlet. Flame-arresting and flame-suppressing designs of proven effectiveness are now available and offer a significant measure of protection against tank explosion.

Engine Fuel Line Disconnect

Proposal: That FAR 25.993 be amended by adding a new section requiring that the fuel feed line between wing/pylon structure and the engine fuel inlet point on turbine-powered aircraft incorporate a suitable self-closing breakaway fitting which automatically closes off flow of fuel in the event of accidental separation of the engine from the pylon. Further, use of such breakaway fittings should be required at locations throughout the fuel system that are known or likely points of airframe distortion or failure due to crash forces.

Explanation and Justification: The U.S. Army has established design criteria for breakaway, self-closing fuel connections used in conjunction with crashworthy fuel tanks in helicopters, and has accumulated favorable service experience with this system. Breakaway fuel fittings could have presented the destruction of both an ONA DC-10, following an engine explosion and fire during takeoff at JFK Airport, and EAL DC-9, following failure of the fuselage at the aft pressure bulkhead on landing at Fort Lauderdale, Florida.

For many years it has been recognized that the requirements of FAR 25.561, which are also applicable to the structure of fuselage fuel tanks by reference in FAR 25.963(d), are inadequate and obsolete. Tests have shown that properly restrained occupants can easily survive 20 G crash deceleration forces. Therefore, we advocate early development of an amendment to FAR 25.561 that will provide a level of strength commensurate with human survivability.

As a protective measure, the Rescue and Fire Committee encourages that use of hypergolic fuels be prohibited in all air carrier aircraft. No matter what use is intended for such fuels, their self-combusting characteristics are undesirable when they are utilized in transport aircraft.

Further, it is recommended that the FAA initiate a program of crash testing of those protective measures for which basic research and development work has already been accomplished. At least the following should be included:

1. Crashworthy fuselage fuel containers conforming to U.S. Army helicopter fuel tank criteria;

2. Crashworthy fuel containers for wing tank areas conforming to strength criteria of lower value than cited in Item 1 (above) that may permit use of lighter weight tank liner materials;

3. Operational inerting systems; and

4. Reticulated foam and aluminum mesh (EXPLOSAFE) installation using various degrees of voiding.

We believe that prototype designs of various forms of explosion prevention systems and crash-resistant fuel tank systems should be installed in aircraft having structural and crash response characteristics similar to contemporary large turbine transport aircraft. These systems should then be subjected to crash testing to demonstrate the effectiveness of each method and to obtain more reliable information on weight, cost, and other penalties. Such a program should be sponsored by FAA with support and assistance by industry and other government agencies. Anti-misting fuel additives are particularly promising means of drastically reducing the post-crash fire hazard. However, much more research and development work remains to be accomplished on them. The same may be said for the permeable membrane system for on-board nitrogen generation. Follow-up research and development aimed at production of viable anti-misting additives and working permeable membrane nitrogen systems joined with a typical transport environmental control system should proceed, and it is recommended that the FAA assign sufficient priority and funding to enable these efforts to move ahead as rapidly as possible.

Fuel Containment

Fuel spillage inside the fuselage area, upon ignition, will create almost instantaneously an unsurvivable atmosphere in the cabin. In the event of a ditching, spilled fuel floating on the water can have a serious effect on survivors, causing damage to the lungs and respiratory tract, potentially resulting in death.

Current requirements pertaining to fuselage fuel tanks include provisions for isolating the tank from passenger areas (FAR 25.967(e)), for withstanding emergency landing conditions (FAR 25.963(d)), and for protection from ground contact. The emergency landing conditions are stated in FAR 25.561 as upward 2.0 G, forward 9.0 G, sideward 1.5 G and downward 4.5 G. These forces are known to be much lower than a person can withstand without injury, if properly restrained in a seat.

The usual construction of wing center section fuel tanks is a flexible, nonmetallic cell located within the wing box - bounded by spar webs, bulkheads, and upper and lower carry-through skin. The wing structure surrounding the cell is consequently very strong and resistant to rupture. Areas in the fuselage outside the wing carry-through structure are less protected and more vulnerable to crash damage. Also, from the standpoint of both fuel spillage and fire-preventing successful post-crash evacuation, tanks located immediately outboard of the fuselage contour are suspect as well.

The U.S. Army development and application of crashworthy fuel systems has been very successful for helicopters. This design criterion is available and can be applied to the design of commercial transport aircraft, but with some weight and capacity penalties. Weight penalties could be reduced to reasonable values by selection of design requirements that are appropriate to the tank location.

Proposal: "Any fuel carried in wing center section of fuselage fuel tank shall be contained in a tank within a tank, the inner tank to be constructed of crash-resistant material. Such tanks shall be equipped with breakaway self-sealing connections. All vent lines for these tanks shall be equipped with a vent flame suppression system."

COMMITTEE POSITION: No. 10

AIR TRAFFIC CONTROL

HAZARDOUS MATERIALS

In the event of an air carrier accident, the immediate response of emergency services precludes information relating to the various quantities of hazardous material being carried on the aircraft from reaching rescuers in time. Therefore, it is recommended that the flight identification number for all flights carrying hazardous materials use the additional letter X (X-ray) or other standard annotation following the flight number.

By this means, air traffic facilities can rapidly warn the rescue crews of the potential problem.

EMERGENCY VEHICLES

In the event of an aircraft accident, the airport manager and/or the FAA Air Traffic Control Facility shall immediately suspend aircraft movements until such time as all emergency vehicles can respond without hindrance and the security of the operational area has been determined.

EMERGENCY VHF COMMUNICATIONS

There are still worldwide problems involving mid-ocean emergency communication capability. Therefore, it is recommended that the Coast Guard sponsor a worldwide satellite VHF communications network, and that all commercial aircraft and shipping monitor the emergency frequency (121.5).

COMMITTEE POSITION: No. 11

CABIN CRASH- AND FIREWORTHINESS AND EVACUATION

Serious aircraft accidents are characterized by a severe post-crash fire that develops rapidly to temperatures in excess of 1000 degrees Fahrenheit. The nature of this fire threat makes it imperative that all aircraft occupants escape a disabled or damaged aircraft in the fastest manner possible, since available survival time is only a matter of a few minutes at the maximum. A successful rapid evacuation is highly dependent both upon effective provisions for escape that are built into the airframe (exits, lighting, slides, etc.) and the ability of the aircrew (both flight and cabin crewmembers) to lead and direct the evacuation of passengers; therefore, the Rescue and Fire Committee recommends the following actions be implemented to ensure that crewmembers and passengers have the greatest probability of surviving aircraft accidents:

1. Emergency Training - All aircrewmembers should receive annual refresher training in aircraft escape procedures after their initial emergency procedures exposure. Such training should take place with the flight and cabin crewmembers working together, rather than training separately; this provides a realistic orientation to the emergency procedures drills and accurately simulates accident experience of the entire aircrew directing cabin evacuation. Aircrewmembers should be made aware of each other's required emergency duties. Additionally, aircrew training should make maximum use of hands-on exercises that utilize actual emergency equipment. This training should offer instruction in:

   a. Smoke and heat characteristics during a cabin fire.

   b. Crash fire patterns.

   c. Electrical fire hazards.

   d. Operation of each type of aircraft fire extinguisher.

   e. Use of rafts, escape slides, ropes, personal flotation devices, and signaling apparatus. Actual use of ropes in a descent from the height of a simulated cabin is essential, in that it stresses the difficulty of a rope descent and the need for proper technique to avoid injury.

   The use of movies and slides in such training should be made supplementary to practice with actual equipment.

   Crew training involving emergency evacuation should include instruction on airport CFR requirements under FAR Part 139. In addition, crew emergency procedures should be revised to provide that a flight crewmember other than the Captain should immediately evacuate the aircraft in an emergency, ascertain the external situation, direct the subsequent cabin evacuation with regard to favorable exit avenues, and effect movement of passengers and crew away from the immediate area of the accident. Comparable flight crew aid should be carried on inside the cabin.

2. Aircrew Protective Garments — To reduce the incidence of aircrew injury or incapacitation by burns, flame and radiant heat retardant materials should be utilized in the manufacture of aircrew uniforms. Synthetic polyester fibers are not at present suitable for use in air carrier uniforms, except when used as a mixture with cotton and wool, due to their tendency to melt in relatively low levels of radiant heat. Only by air crewmembers and air carriers actively encouraging development of flame-retardant materials will flame-retardant uniforms become available.

   At present, the chance of preventing or minimizing fire burn injuries can best be accomplished by:

   a. Selecting tightly woven, natural-fiber materials such as gabardines.

   b. Avoiding use of high-polyester-content garments.

   c. Wearing long-sleeved shirts, blouses, or coats.

   In addition, air crewmembers should be encouraged to own and to maintain gloves that are accessible to them in flight for use as hand protection from flame or heated-material aircraft parts. Quick-don-style head coverings or "hoods" should be provided for all crewmembers to ensure evacuation success, since such hoods provide valuable protection from heat and smoke, and thus allow crewmembers supervising emergency evacuation the vital few minutes necessary to direct escape from a post-crash fire.

   All flight crewmembers should wear uniforms that are easily recognized as such, together with rank identification that will provide a distinct sign of authority in the event of an emergency. This should include shirt epaulets for cockpit crew and senior cabin staff.

3. Cabin Equipment - Aircraft cabin structures and cabin interiors should be designed and equipped to ensure occupants' ability to survive and evacuate under emergency conditions. This should include at least the following items:

   a. Occupant egress difficulties should be minimized by installation of only Type 1 or Type A emergency exits.

   b. All seats, galley equipment, closets, cabin baggage bins, etc., should be designed to withstand 20 G longitudinal and 10 G lateral dynamic loads to prevent their being deformed or broken during a crash and in any way blocking exits or injuring cabin occupants.

c. In addition to emergency lighting now located in the ceiling, additional cabin emergency lighting should be installed at or below seat level to prevent its obscuration by dense smoke, and cabin exits should be brightly illuminated to permit rapid identification under emergency circumstances.

d. Flight compartments or cockpit doors should remain open during takeoff and landing and should be constructed with integral "kickout" panels that would allow flight crewmembers to escape from the cockpit in the event that the cockpit door becomes inadvertently jammed shut during an accident.

e. Lightweight trash compactors should be installed in galley areas to allow compact bundling of cabin service litter, since compacted solid waste is much more difficult to ignite. This would also eliminate the current accumulation of bulky trash bags in cabin escape areas.

f. Lavatory and galley facilities should preferably be located in the midpoint of the cabin and not against the cabin wall where a fire could rapidly develop before being detected.

g. Crash axes that are currently part of required emergency equipment on board air carrier aircraft are ineffective when used to pry open jammed emergency exits, doorways, or dislodged cabin bulkheads. Alternate, new-design crash axes should be utilized that incorporate prybar features for use as described above.

h. All cabin interior furnishings should consist of fire-resistant materials that are self-extinguishing once ignited and that produce low quantities of toxic gases and smoke. Such criteria would aid and ensure a clear view of emergency routes and exits to aircraft occupants and minimize fatalities by gas or smoke inhalation. Polyurethane foam seats should be replaced with polymide foam or similar materials which meet this requirement. When polyurethane is used, it should be totally enclosed with a fire-blocking material such as polyimide or vonar.

i. Passenger carry-on baggage items should be restricted to those which do not produce large quantities of toxic smoke or gases when subjected to cabin fires.

j. All seat trays should be located in the armrests, not in the seat backs, to prevent crash injury and not impede evacuation when seat back tray tables are dislodged.

k. Emergency exits shall be capable of being rapidly closed if inadvertently opened into a fire area. Where this is not possible, a fire-resistant, radiant-heat-reflective curtain should be available and so located that it can be rapidly deployed. This will delay unsurvivable heat rise in the cabin area in the event of an external fire.

l. An aircraft must not be dispatched with passengers aboard when any emergency exit is inoperable in the emergency mode.

m. In order to prolong the duration of a survivable atmosphere in an aircraft cabin involved in exterior fire, it is essential that all cabin sidewalls be well insulated with a thermal acoustic material such as "litaflex" capable of withstanding temperatures of 2000°F. The aircraft stringers and interior skin should be painted with intumescent paint. The effect of heat on the paint will cause it to bubble and seal any air spaces between the insulation and the structure.

n. Epoxy laminate polycarbonate window material which will not melt or shrink under normal crash fire temperatures for at least 5 minutes should be retrofitted to all aircraft.

o. Research should be conducted on the value of intumescent paint on outside surfaces of the structure.

4. Cabin Fire Extinguishers

Historically, ALPA has been opposed to the use of any fire extinguisher in the cabin area which in itself presented additional toxicological problems to the user (carbon tetra-chloride). However, with the advent of wide-body aircraft and new methods used by hijackers, additional specifications are found to be necessary.

a. Cabin Areas

For flight deck electrical fires, one CO_2 extinguisher should be carried for fires usually located behind the circuit breaker panel. For passenger aircraft, Halon 1211 extinguishers should be carried on board since they can be effectively used against all types of fire (A, B, or C). This will prevent inadvertent use of the wrong extinguisher by passengers or crewmembers. In addition, for Class A fire, there is usually a large quantity of water available or liquids such as coffee or soft drinks. These can be used effectively against seat fires. Due to possible toxic effects from the use of Halon 1211, the size and quantity of extinguishers on board small aircraft may be adjusted to the cubic capacity of the cabin. For air carrier aircraft, 5 pound extinguishers are recommended.

While the toxic effects of Halon 1211 are recognized, the degree of toxicity is compensated for by the superior knock-down qualities of the extinguishing agent. Complete extinguishing of any airborne fire is mandatory and takes precedence over all other factors.

NOTE: It must, however, be recognized that some products of extinguishment resulting from the use of Halon may cause medical problems for hydrogen floride may have some effect on the eyes and carbonyl floride may have an effect on persons with coronary problems.

b. Cargo Compartments

Class D cargo compartments of over 500 cubic foot capacity have been found to support combustion long enough to enable the cargo wall to burn through, resulting in fire spreading to adjacent areas. Compartments of this size or larger should be equipped with both fire detection and extinguishing capacity. All cargo compartments, regardless of size, should be lined with additional insulating materials capable of containing the maximum degree of fire obtainable with the oxygen available in the compartment during in-flight conditions.

c. Fire-detection and fire-extinguishing systems should be installed in aircraft cabins for use in lavatories and galleys as well as the overceiling areas of wide-body aircraft.

5. Evacuation Devices

a. All evacuation devices should be designed with the capability for being used as an emergency flotation device in the event of a water landing. This capability shall include a quick detach girth and a mooring line for separation and launching in the flotation mode.

b. Due to a high injury rate during use, evacuation devices should be designed with high sidewalls or rails, to prevent evacuees from falling over the sides during descent.

c. Evacuation devices should be designed utilizing heat resistant material and coated with a highly reflective coating to obtain maximum radiant heat protection.

d. Evacuation devices should be designed so as to provide a safe sliding angle in the event of a collapsed landing gear during evacuation.

e. Straps or other devices should be installed to prevent inadvertent inflation of evacuation devices inside the cabin. This protection should include protection on doors used opposite collapsed landing gear(s).

f. Evacuation devices should remain usable in a 25 knot wind from any direction.

g. Auxiliary evacuation ropes should be installed to be used in the event of failure of the primary evacuation system.

COMMITTEE POSITION: No. 12

OVERWATER EMERGENCY EQUIPMENT

The Rescue and Fire Committee is concerned that air carriers maintain appropriate water-survival equipment on flights operating over large bodies of water and upgrade currently available water-survival equipment for flights which include overwater airfield departures or arrivals. Since the majority of air carrier accidents occur with little or no warning during approach to or departure from airfields, new emphasis should be placed on providing passengers and aircrew members with water-survival equipment that is readily accessible and can be donned or deployed with minimal preparation.

It is essential that aircraft occupants involved in a ditching accident remain out of the water if at all possible.

The serious effects of hypothermia can be fatal to accident survivors in a relatively short period of time, depending on water temperature, even when they are wearing inflatable life vests.

At 32°F 50% of the survivors would be dead within 10 minutes
At 32°F 99% of the survivors would be dead within 1 hour, 20 minutes

At 41°F 50% of the survivors would be dead within 20 minutes
At 41°F 99% of the survivors would be dead within 2 hours, 15 minutes

At 50°F 50% of the survivors would be dead within 30 minutes
At 50°F 99% of the survivors would be dead within 3 hours, 20 minutes

Various levels of dysfunction such as unconsciousness and uncontrollable shaking will occur in less time than indicated. This would reduce survival times still further should floatable seat cushions be the only personal survival equipment available.

The colder the water, the greater the potential for hyperventilation, which would ultimately lead to water (and possibly spilled kerosene) ingestion and drowning. On the other end of the temperature range (above 68 F) is the increased potential for shark attack.

Accordingly, the committee makes the following recommendations:

1. The type and amount of overwater emergency flotation equipment carried on board transport aircraft should be determined by type of operation, e.g., extended overwater operation or minimum overwater operation. The division of categories should be primarily predicated on the limit of radar coverage:

   a. Extended Overwater Operations -

      On all overwater flights that operate beyond the range of ATC radar or that operate over water in geographic areas that are not covered by search and rescue (SAR) facilities, aircraft should be equipped with full, open-ocean survival equipment to include life rafts, life vests, and emergency locator beacons. This same requirement should apply to areas that are served by SAR facilities that are nominal or ineffective in capability.

b. Minimum Overwater Operations -

Minimum flotation equipment for these operations should consist of an auto-inflatable slideraft or slide designed with raft capabilities; a simple, quick-donning life preserver which can be used without instruction; and flotation cushions.

Equipment suggested for minimum overwater operations would be well suited for use in unplanned water landings during approach to and departure from airfields as well as ditchings which might occur within a two-hour radius of SAR facilities. In such situations, full, open-ocean survival equipment would not be necessary, but flotation equipment would remain a critical need.

2. Use of seat cushions as approved flotation devices should be deemphasized due to the minimal buoyancy of such cushions and to the fact that a survivor must be conscious to utilize them. FAA action to eliminate the approved status of flotation cushions as the primary means of emergency flotation would parallel past actions of the U.S. Coast Guard in no longer accepting cushions as lifesaving devices. Seat cushions are effective only as supplementary flotation equipment.

3. Improved life vests that would fit in seat backs or headrests and thus be readily accessible for emergency use should be developed. Currently, placement of life vests under passenger seats makes them difficult to reach under adverse circumstances and allows access to be restricted by underseat baggage.

4. Combined evacuation slides and life rafts (slide/rafts), such as have been installed in wide-body aircraft, should be developed for installation in narrow-body aircraft. This would ensure provision of a raft capability for all air carrier aircraft and eliminate the difficulties associated with lifting and moving current rafts inside the passenger cabin.

5. Currently installed, standard evacuation slides should be fixed to emergency exits with quick-detach girths that allow the slides to be inflated and then detached from the aircraft. This would allow the slide to double as emergency flotation equipment for present line equipment that does not have and is not required to have rafts installed. The intention of this recommendation is not to substitute slides for rafts, but to provide emergency equipment that can be rapidly deployed phase of flight. Quick-detach girths are currently available commercially.

6. Experience has shown that cabin attendants are unable to inflate the slide or locate the standard girth release when the cabin floor is submerged, after ditching. Therefore, it is desirable that slides/sliderafts should automatically deploy and inflate when the door is opened, from the inside, in the emergency mode. Similarly, it is desirable that girths be auto-detachable to ensure that the slide/slideraft will free itself and float clean of the aircraft when water rises above the floor; however, the slide/slideraft should remain tethered to the aircraft. Auto-inflation and detaching features will prevent the slide from blocking evacuation points and/or sinking with the aircraft.

COMMITTEE POSITION: No. 13

CARRIAGE OF HANDICAPPED PASSENGERS

The ALPA Rescue and Fire Committee fully supports the principle that the national air transportation system should afford handicapped persons opportunity to travel by air. However, the Committee feels that certain factors must be taken into account when persons of restricted ambulatory capability choose to use commercial air transportation.

The transport category aircraft is a unique mode of transportation in that it is designed to carry a large number of passengers in a confined space that has relatively few means of exit. Thus, whenever air transport of handicapped persons is planned, consideration must be given to factors involved in an emergency evacuation such as high-density seating, above-floor emergency hatchways, narrow aisles, aircraft height above ground, emergency slide/raft configuration, and cabin damage or deformation. The FAA has published an Advisory Circular (AC 120-32, "Air Transportation of Handicapped Persons") that discusses many of the factors mentioned above and is an excellent reference for airline personnel who must adapt to the unique considerations which must be accounted for whenever handicapped persons are boarded on passenger-carrying aircraft. It is well written and provides useful insights regarding treatment of handicapped passengers and typical precautions that should be taken for various types of infirmity. AC 120-32 is thorough and specific, even to the point of recommending various seating locations for specific types of impediments, and is a valuable resource for development of policies regarding transport of handicapped persons.

The Rescue and Fire Committee concurs with amendments to FAR Part 121 that require air carriers to develop procedures covering carriage of handicapped passengers and that make individual emergency evacuation instructions for handicapped passengers, prior to takeoff, a requirement. However, the Committee feels that several elements of air carrier transport of the handicapped have been omitted from Part 121. Accordingly, the Committee makes the following recommendations:

1. The Captain must be informed, prior to taxi, of the number of handicapped passengers on board, their locations in the cabin, and their degree of infirmity.

2. The number of passengers needing the assistance of another person to move expeditiously to an exit in the event of an emergency should be limited to:

    a. Unaccompanied by a personal attendant - limit of one passenger per floor level slide-equipped exit.

    b. Accompanied by a personal attendant - limit of twice the flight attendant minimum crew complement.

3. In the event of special circumstances such as charter flights and flights serving major retirement areas of the country or medical facilities, when the number of nonambulatory handicapped passengers on board is greater than that described in item 2 above, the airline involved should request that airfield emergency equipment stand adjacent to the runway for flight departure and arrival.

4. Since many handicapped persons with restricted ambulatory capability have a high degree of self-sufficiency and mobility when allowed to move about on their own, seat assignments should be made so that handicapped persons will be seated equidistant from emergency exits. Such seating locations would allow handicapped persons to make their own way or be assisted to an emergency exit without being overtaken by other evacuees or impeding a smooth evacuation flow.

5. Blind persons shold carry telescopic canes wherever possible; care must be taken to prevent canes from puncturing inflatable emergency escape slides.

6. For minimum overwater operation (see position No. 12) limited overwater emergency equipment must be carried, since handicapped passengers would be likely to require such aid. The blind would be unable to see the quickest route to the shore; those with physical problems may be unable to swim or hang on to a seat cushion; therefore, a life vest and slideraft are required.

COMMITTEE POSITION: No. 14

FUELING

AIRCRAFT FUELING PRACTICES

When aircraft are being fueled with passengers aboard, the following additional precautions should be taken:

1. When an aircraft is equipped with integral stairs and a jetway is not positioned, these integral stairs should be deployed.

2. At doors not being used for loading or servicing, emergency evaucation slides should remain armed for immediate deployment.

3. A trained cabin attendant or person fully trained in the evacuation of the aircraft type involved should be stationed by each exit during the fueling operation.

4. Aircraft fuelers should have direct emergency communication with the fire services.

AIR LINE PILOTS ASSOCIATION
31st EXECUTIVE BOARD MEETING
May 15-17, 1979

SUBJECT
Overwater Emergency Flotation Equipment

STATEMENT OF QUESTION
Should the 31st Executive Board adopt as policy requirements for overwater emergency flotation equipment?

SOURCE OF AGENDA ITEM
NAL MEC

RESOLUTION OF THE EXECUTIVE BOARD
WHEREAS there is a strong movement by government and industry representatives to relax requirements for overwater emergency flotation equipment, and

WHEREAS it has been shown that in addition to mid-ocean ditchings the majority of water accidents occur on landing or takeoff with occupants unprepared for the emergency, and

WHEREAS some new aircraft are not being designed with slide rafts capable of rapid deployment in such an emergency,

THEREFORE BE IT RESOLVED that the Association, through the Office of the President, make every effort to have requirements accepted by the FAA that would ensure that all aircraft which land or take off over water or are engaged in overwater flying be equipped with flotation equipment suitable for the type of operations as follows:

1. The type and amount of overwater emergency flotation equipment carried on board transport aircraft be determined by type of operation, e.g., extended overwater operation or minimum overwater operation. The division of categories should be primarily predicated on the limit of radar coverage:

    a. Extended Overwater Operations -

    On all overwater flights that operate beyond the range of ATC radar, or that operate over water in geographic areas that are not covered by SEARCH AND RESCUE (SAR) facilities, aircraft should be equipped with full open ocean survival equipment to include rafts containing a full emergency package, life vests, and emergency locator beacons. This same requirement should apply to areas that are served by SAR facilities that are nominal or ineffective in capability.

Analysis and Comments
# of the
Air Line Pilots Association
on the
HH Aerospace Design Co., Inc.
CFR Cost/Benefit Analysis

INTRODUCTION

The Air Line Pilots Association, representing the interests of over 34,000 professional air carrier pilots, has a well known and long standing interest in refining and improving all aspects of aviation safety for passengers and crew. For this reason we are compelled to comment on those recommendations found in the HH Aerospace CFR Cost/Benefit Analysis which, if implemented, will eliminate the present level of fire and rescue safety at many air carrier airports. The specific recommendations which this Association cannot presently accept are; 1) the total elimination of CFR services at A, AA, and B index airports, and 2) the recommendation that no CFR services should be required at commuter (FAR Part 135) airports.

BACKGROUND

When this Association was invited to participate on an industry working group during the initial stages of this study, it was with the understanding that the purpose of the study was to address the most cost effective means to improve the effectiveness and efficiency of the CFR (Crash/Fire/Rescue) services as they now exist. Between that meeting on February 27, 1979 and the final release of the report, the focus of the study changed from ways to improve the efficiency of the CFR service to ways to eliminate costs; including total elimination of CFR services at air carrier airports which serve aircraft as large as Boeing 737s and McDonnell Douglas DC-9s.

The FAA, in November of 1982, invited interested members of the aviation community to a "listening session" to discuss the revision of FAR Part 139 (airport certification) prior to the issuance of a Notice of Proposed Rulemaking (NPRM). While the FAA representatives present at this meeting discussed each area of Part 139 under consideration for revision, including CFR requirements, there was no solicitation for opinions from the industry representatives present on these proposed changes. In response to a question during this meeting from an ALPA representative concerning the recommendations found in the HH Aerospace, a high ranking FAA official said the findings in the report would be accepted as valid because no one has proven their invalidity. ALPA, as a result of this statement and the lack of objectivity it represented, contracted an independent statistical consultant to review the study. While the consultant's time for review was limited due to the reported imminent release of the NPRM on this topic and the study's voluminous size, his findings indicate there are serious inconsistencies in the methods used, and the findings, of the study. His conclusion, in part, states, "I can only conclude that the work done in this study is incomplete. The report can be attacked on its lack of statistical analysis, arbitrary parameter assignments, (and) unexplained data base manipulations." (attachment 1, Barron's report)

These findings indicate that blind acceptance of the report's recommendations for policy decision guidance would be ill advised. The report's large size and large amount of funds spent for its generation does not justify unquestioning acceptance of its findings.

ANALYSIS OF DATA SELECTION

In reviewing the study and its recommendations, we have found that many of the assumptions used to generate the recommendations are in error. One of the most basic errors appears on page 7 of Volume 1 of the HH Aerospace Study where the contractor states, "The fire fighter's job is not so much to remove physically the survivors from the burning aircraft; that is the responsibility of the crew. Rather, the CFR fire fighter's job is to maintain an environment which will allow the crew to evacuate the aircraft. Second, the CFR fire fighters should save as much of the aircraft hull as possible." (attachment 2) This statement contradicts the existing standards and recommended practices of ICAO, FAA, and the NFPA. NFPA states in its 403 manual, Recommended Practice for Aircraft Rescue and Fire Fighting Services that, "Aircraft rescue as used in this text means the fire fighting action taken by an emergency crew to prevent, control, or extinguish fire involving or adjacent to an aircraft for the purpose of providing maximum fuselage integrity and an escape area for its occupants. The emergency crew, to the extent possible, will assist in evacuation of the aircraft using normal and/or emergency means of egress. Additionally, emergency crews will, by whatever means necessary, enter the aircraft and provide all possible assistance in the evacuation of the occupants". (attachment 3) Section 12.1.14 of Part 1 of ICAO's Airport Services Manual states, "Rescue of aircraft occupants should proceed with the greatest possible speed. While care is necessary in the evacuation of injured occupants so as not to aggravate their injuries, removal from the fire threatened area is the primary requirement." (attachment 4) The FAA states in FAR Part 139 that, "The applicant must show that the fire fighting and rescue personnel are familiar with the operation of the fire fighting and rescue equipment and understand the basic principles of fire fighting and rescue techniques." (attachment 5)

Fire fighting is but one aspect of total CFR. All three organizations referenced above recognize the importance of rescue in any given situation.

The contractor, in concentrating on the benefits derived from accidents with life threatening fire which must be extinguished, is ignoring rescue and many of the other equally important and beneficial aspects of CFR.

ACCIDENTS

On November 11, 1965 several passengers and crew were trapped in the ventral stairs of an United B-727 when the aircraft crashed on landing. There was fire as a result of the accident which threatened the survival of these individuals. CFR services responded and controlled the fire but did not extinguish it. Control of the fire allowed other CFR personnel the opportunity to force entry into the aircraft and rescue these individuals. Without this rescue effort the survivors would have died. (attachment 6) On August 8, 1975 a Continental B-727 crashed shortly after takeoff due to wind shear at Denver. Due to interior breakup of the aircraft, two flight attendants were trapped for 20 minutes. CFR entered the aircraft and rescued these individuals. During this same period, CFR was on guard to prevent fire which could have erupted at any time. This was a situation where the specialized rescue skills of trained CFR personnel were clearly necessary. (attachment 7) On June 26, 1978, an Air Canada DC-9 aborted a takeoff at Toronto, Canada due to tire failure. The aircraft overran the end of the runway and went down a sharp incline. Two people died out of 107 passengers and crew. The vast majority of occupants required specialized rescue due to interior breakup of the airplane, serious injuries, and due to the very real possibility of fire the engines and aft fuselage area were covered with a foam blanket. (attachment 8)

In the above accidents, rescue played an important part in the successful resolution to life threatening situations. These accidents are referenced to highlight the fact that CFR serves more of a useful function than just fighting fire. The primary purpose of CFR is to save lives and prevent injuries with fire fighting as just one aspect of that function. The contractor, in their analysis, reviewed 628 air carrier accidents looking for accidents that could have, or did, benefit from CFR. In concentrating on those accidents in which CFR provided a benefit solely from fighting the fire, they ignored the total purpose of CFR, thus the total benefits of CFR.[1]

We find that this perspective biases the study and severely limits its scope. The contractor's criteria for data selection was very narrow and limited. A more realistic view of CFR's purpose and benefit would have resulted in a much larger, and therefore more representative, data base. The three accidents referenced above indicate that there are clear life saving/injury preventing benefits of CFR that the contractor chose not to address.

When the contractor discusses the methods used to determine what data to select, they state, "1966 was chosen as the first year for which to collect data because prior to 1966 piston-driven aircraft, now relatively rare, comprised an important part of the national aircraft fleet. Therefore, data from earlier years would have been of limited relevance to an understanding of the current and future benefits of CFR".[2] This statement is misleading and totally incorrect. Turbine powered air carrier aircraft were introduced into commercial service in the early to mid 1950's with pure jet aircraft coming into commercial service in the late 1950's. We have identified 64 major turbine powered air carrier accidents in the period from January 27, 1959 to December 8, 1965; the same period of time the contractor stated as having limited relevance. (attachment 9) Of the 4,359 passengers on board these aircraft, 330 (or 13%) died. We have been unable to estimate how many injuries have caused these accidents due to the lack of accurate accident data. It is safe to assume that many passengers who were injured or died could have benefited from CFR if it had been available.

We also are concerned that air carrier accidents and CFR services outside the United States were not addressed. The airline industry and its operations are international in character. The problems experienced here in the United States may or may not be experienced elsewhere. However, when an air carrier aircraft crashes, the problems become the same for the survival of the passengers and crew. By not reviewing air carrier accidents worldwide, valuable information was ignored which would have influenced the perspective of the contractor to the benefits of CFR. (A good example of actual or hypothetical benefits of CFR would be the Egypt Air B-707 accident at Geneva in 1982 and the Spantex DC-10 at Malaga Spain in 1982.) By ignoring similar data sources, the contractor severely limited his accident history data base, which makes any conclusions based on this limited data highly questionable. In reviewing the ICAO ADREP report for the first two quarters of 1982, we have identified 57 accidents of large aircraft where CFR might have proven beneficial. (attachment 10 - the accidents are marked by a asterisk)

Another fact which makes the contractors selection criteria for accident data inclusion highly questionable are the statistics contained in attachment 11. These statistics were derived from FAA incident/accident statistics. This summary of incidents/accidents requiring CFR response on airports for calendar years 1974 totals 628 flights. Of these 628 flights, 455 had a total passenger count of 35,781. The other 173 flights had no passenger information. Each one of these responses was due to the potential for a serious accident occurence. The contractor identifies 42 accidents during the period from 1966 to 1978 in which CFR, according to their criteria, had some benefit. (This is an average of 3.23 accidents per year which would benefit from CFR.) The accident/incident summary compiled by HH Aerospace for calendar year 1974 alone identifies 628 CFR responses. The pilots of this Association do not request these CFR services unless there is a justifiable reason for their response. The tremendous discrepancy between the contractor's average beneficial response per year (3.23) and the response history for 1974 (628) is confusing. Why would there be 628 CFR responses in one year if only 3.23 responses could prove beneficial? This question and its answer is better understood if it is recognized that the vast majority of CFR responses are due to notification from pilots, airport operations, and control tower personnel of situations in which CFR will be of assistance. All of these individuals are knowledgeable members of the aviation community who are aware of the potential of serious accidents and the benefit of CFR. The contractor in identifying the 42 accidents in which CFR proved of benefit over a 13 year time period has obviously used selection criteria which is unrealistic and overly restrictive. The fact that the information on the original 628 accidents surveyed by the contractor for the 13 year period was not included in the report makes it impossible to further critique his selection criteria. However, the contractor does estimate that of the 628 accidents studied, 221 involved actual or potential crash injury or death due either to fire or trauma. These accidents, when analyzed by airport index, occured at all the index airports, with approximately 16% occurring at the A, AA, and B index airports.

Contrary to the original stated purpose of the report, the contractor focused his attention on justifying the cost of CFR service with respect to the benefits derived from that service. (As stated earlier, it was this Association's understanding that the study was designed to address means to improve the effectiveness and efficiency of the CFR service as it now exists.) The implied rationale of this approach is that CFR must not cost more than the benefit derived from its use. In other words, the value of CFR was judged on a purely monetary basis with those airports not showing a "CFR profit" judged to be an expensive extravangance. As mentioned in our letter on this topic to the FAA dated September 20, 1982, (attachment 12) essential emergency service, both airport and municiple, is not designed to provide a profit but to provide a service to the citizens.

COST ASSUMPTIONS

In reviewing the methods used by HH Aerospace to determine the costs of this service, we again find that many of their assumptions are in error. For example, the methods used to collect the cost data is poorly documented in the report. During the briefing held by the FAA for industry in June of 1982, the contractor indicated that they derived their cost data from visits to FAA Regional Headquarters (to research the costs in their Part 139 certification records), and actual visits to the airports to determine the costs not accounted for in the FAA's records. During this same meeting, the speaker representing the HH Aerospace Design Company indicated that they actually visited 95% of the index E airports (16 airports) and a little less than 5% of the index A (8 airports) to determine the representative costs not contained in the FAA records. The percentage of visits to the other index airports (AA through D) increased proportionately. Our concern with this statement is that a sample size of a population (in this case, index A airports) of 5% is a unrealistically small sample on which to base such important conclusions. Additionally, the non-certificated airport data, in which the FAA has no cost data for CFR (since none is required), was included in this data base solely by estimation. The interviews, the questions asked, and methods used to gain this information are not documented other than a statement indicating the airports were surveyed.[3]

The inclusion of non-certificated airports, and airports with more CFR capability than required by FAR Part 139 is misleading. The contractor based his CFR cost information on this data and not the data based on Part 139 requirements. It must be recognized that the costs outlined in this study do not reflect the actual costs of providing CFR to the FAA standard as outlined in FAR Part 139. All of the extra CFR capability, (which increases cost) is a result of the airport authorities assessment of their needs locally and is totally a function of their knowledge of their safety needs. (This emphasizes the fact that FAR Part 139 is a minimum standard and many airport operators do not feel that this minimum standard provides sufficient protection).

The influence of including the now certificated airport CFR costs and the costs of providing CFR services to a level greater than required by FAR Part 139 can be seen in the following tables (Note: These tables were developed using cost data and figures obtained from the HH Aerospace Study, Volume 1, unless otherwise noted).

Table 1 outlines the manpower costs to fund to FAR Part 139 requirements. Present day CFR vehicle technology has advanced to a point that a vehicle can be driven and operated by a single individual. This fact was combined with the shift factor outlined in the HH Aerospace Study and the minimum number of vehicles required by Part 139 to generate the cost figures for manpower required for Part 139 minimum requirements. The total yearly cost for manpower for Part 139 requirements at A, AA, and B index airports is 15.079 million dollars; 5.5 million dollars less than the HH Aerospace cost estimate for these airports. The cost for manpower to Part 139 minimum standards at all certificated airports in the United States is 42.9 million dollars; 48.892 million dollars less than the HH Aerospace estimated figure for CFR manpower costs.

Table 2 outlines the costs to build firehouses on the airport to house the vehicles required by Part 139. It must be pointed out that at many of the smaller airports no firehouse structure is required due to the lack of overnight operations (sleeping quarters for the men) and/or mild weather conditions. It has been determined that many small airports house their CFR vehicles in structures used for other purposes (such as aircraft hangars). For index A, AA, and B airports the total cost per year is 1.054 million dollars. With Federal Funding under ADAP at 80%, the actual cost to the airport operator is $210,000 per year. The HH Aerospace Study estimates this figure for these index airports to be 1.53 million dollars per year. The difference between this cost and the cost to provide shelter for the required vehicles is $475,000. When ADAP funding is considered the difference between the HH Aerospace cost estimate and the airport operators cost is 1.32 million dollars. The difference between this cost for all airports and HH Aerospace's estimate is 2.922 million dollars (6.33 million dollars if ADAP funding is considered).

Table 3 presents the costs of CFR equipment and materials to meet the minimum requirements of FAR Part 139. The actual cost of this equipment to meet Part 139 requirements at A, AA, and B index airports is $263,000 a year ($52,600 if ADAP funding is considered). HH Aerospace estimates costs for these airports to be $793,000 per year (a difference of $740,000 if ADAP funding is considered). The difference for providing this equipment for all airports to meet Part 139 requirements versus the HH Aerospace estimate is 3.067 million dollars (3.5 million dollars if ADAP funding is considered).

Table 4 outlines the costs of providing CFR vehicles to meet the minimum standards of FAR Part 139. The yearly cost to index A, AA, and B airports is 2.4 million dollars a year ($483,000 with ADAP funding). The HH Aerospace Study estimates this figure to be 4.373 million dollars per year. The difference between this figure and the actual cost to provide Part 139 coverage is 1.973 million dollars per year (3.890 million dollars if ADAP funding is considered). The difference between these two values for all airports is 5.843 million dollars (11.274 million dollars if ADAP funding is considered).

Table 5 is a summary of all the costs of providing CFR service up to the minimum standards outlined by the FAA in Part 139 at index A through E airports.

Table 6 is a comparison of the total estimated costs of CFR as reported by the contractor and the summary of costs required to provide CFR up to the minimum standard of FAR Part 139. At A, AA, and B index airports, the total cost to provide CFR up to Part 139 is 19.7 million dollars (15.824 million dollars if ADAP funding at 80% is considered). HH Aerospace estimates the costs of providing CFR service to be 27.294 million dollars per year. The difference between the HH Aerospace estimate and the actual cost to provide CFR to the FAA standard is 7.594 million dollars (12 million dollars if ADAP funding is considered). This difference in costs works out to a per airport (all A, AA, and B) difference of $24,655 per year/per airport ($38,961 if ADAP funding is considered). The total cost per year to provide CFR service to all A through E airports to the FAA minimum requirement is 55.485 million dollars. The contractor estimates this figure to be 115.321 million dollars. The difference between these two figures is 59.853 million dollars (70.074 million dollars if ADAP funding is considered).

The contractor uses these cost figures to develop a cost per passenger for CFR service (protection) at index A through E airports. These cost figures are helpful in that they allow the reader to put into perspective what the very large cost figures contained in the report really mean. But these figures are very misleading, as can occur with any simplification of complex data. The contractor, in reducing CFR cost to a per passenger cost, uses only enplaned passengers. This approach does not take into account the aircraft movements with relatively few enplanements such as a flight which stops at a small terminal enroute from a large hub to another large hub (this is a quite common occurence). Other factors not considered in this approach is the effect of seasonal fluctuations, holiday travel loads, and economic infuences. These factors must be considered as an aircraft can be filled even though the air carrier industry as a whole may be experiencing reduced load factors. Every seat must be considered potentially filled with a passenger to be protected if a realistic appraisal of CFR costs per flight is to be made.

In Table 7, calculations have been made to compare the per seat cost of providing CFR protection to FAA minimum requirements in comparison to the contractors estimated cost per enplaned passenger. As can be seen, cost per seat to provide the minimum protection as required by the FAA is dramatically lower than the contractor's figures. The per seat cost is the only rational way to determine the real meaning of the CFR costs since the presence of CFR is for the life safety of the passengers and crews.

PASSENGER SURVEY

During this review, ALPA representatives surveyed a large number of air carrier passengers at a variety of air carrier terminals. The question put to these passengers was what was the value of the CFR service to them? Would they be willing to pay extra for that service? Would they be willing to pay three dollars extra per ticket for this service? The findings of this limited survey are contained in attachment 13. Almost all the passengers expressed concern and disbelief that there was presently serious consideration of eliminating this CFR service at smaller air carrier airports. The survey indicated that not one passenger was unwilling to pay for this service. In considering the contractor's recommendations, we strongly encourage the FAA not to lose sight of the purpose of CFR and who it is designed to serve. If the responses to the ALPA survey is any indication, the traveling public is more aware and concerned about flight safety than ever before.

COMMUTER AIRPORT CFR

We are seriously concerned that the contractor recommends that the FAA not consider requiring CFR at commuter airports. This recommendation is based on limited information, mainly accident briefs. On page 65 of Volume 1 of the HH Aerospace report the contractor states, "It is estimated that CFR saves .5 lives per year in these accidents (at commuter airports). This statement, which is probably an overstatement of CFR benefits, is based on general considerations rather than on a reading of detailed accident reports . . .".

It is quite obvious from this statement the contractor did very little research on this question. These statements are not substantiated in any way and are based on what is best described as a preconceived bias. This is confirmed by a statement in the next paragraph which reads, "Of the 246 accidents examined, only 10 involved fire at an airport with CFR and an aircraft damage report of substantial rather than destroyed". This indicates the contractor did not consider those accidents in which CFR might have proven beneficial (as pointed out earlier in the report) nor did they research enough to learn that an aircraft destroyed does not automatically mean all aboard died. It means that aircraft will never fly again. (The Continental DC-10 at Los Angeles in 1978 was "destroyed" with only two fatalities). The next sentence reads, "These are the only accidents, therefore, in which CFR could have played a role in reducing property damage". This statement, like the others, is based solely on preconceived notions and not facts or theories based on research. It is inconceivable that such little attention was paid to this question of CFR service for commuter airports. One page of analysis, out of 1,200 pages, is a good indication of the relative importance attached to this question.

The commuter airline activity in this country is steadily growing as is the size of the aircraft used (a DH-7 has a seating capacity of 50 passengers). To base any policy decisions on this very limited analysis would be questionable. The Air Line Pilots Association strongly encourages the FAA to do what research is necessary to make a decision on the best course to follow based on factual information. The FAA proposal to look at CFR at airports served by commuter aircraft seating 30 or more is acceptable. As far as the level of protection, this should be based on NFPA and ICAO criteria.

NON-REGULATORY CFR

In addressing the question of CFR at smaller airports HH Aerospace claims that these smaller airports will maintain a certain level of safety if the CFR requirement is dropped. Undoubtedly, many will (as existed prior to the issuance of FAR Part 139) but some will not. We are concerned that without the requirement from the FAA, many airport operators will not maintain the CFR services as needed.

The Association's Rescue and Fire Committee conducted a survey of the rescue and fire facilities at air carrier airports in 1968, 1969 and 1970 (attachment 14). These surveys found that 216 airports out of 562 had no CFR service in 1968 (38%), 196 out of 545 had no CFR service in 1969 (36%), and 146 had no CFR service out of 523 in 1970 (30%). Many of the airports which did have CFR had CFR well below present day standards. These airports during the period 1968 through 1970 were not required to have CFR. If the same situation arose today (no regulation), there is no guarantee there would continue to be adequate CFR at the smaller airports.

At this point, we would like to offer comments on the remaining recommendations made by HH Aerospace as a result of their study.

CFR BASED ON ACTIVITY

In section 2.2.2 of Volume 6, HH Aerospace recommends assigning the CFR index on the basis of activity. We agree with this concept although there are certain items of concern. We find FAR Part 139.49(a) 1, 2, unacceptable, as it presently reads. According to HH Aerospace (attachment 15) there were 7,338 flights larger than index A that flew into index A airports in 1978 (8 of them were index D and E aircraft).

While this is a small percentage of the total flights that flew into index A airports that year (179,968), 500 pounds of dry chemical would be useless in a B-747 or DC-10 fire. With these concerns in mind, we would find a remission factor based on the ICAO index acceptable as long as only one remission level is used (as is presently done by the British CAA).

AMOUNT OF AGENT

In section 2.3.2, HH Aerospace recommends that increasing the amount of extinguishing agent be considered. We must comment on the exclusion of index A, AA, and B airports in this discussion. It was inappropriate for the contractor to eliminate the discussion of this factor for index A, AA, and B airports. In writing their report the contractor was not determining policy, that is the FAA's task. The contractor should have supplied the FAA with accurate, unbiased information on all the indexes so the FAA could make determinations based on this information.

The purpose of increasing agent quantities is to more effectively fight and control a fire. (In the DC-10 accident at Los Angeles 7,500 gallons of extinguishing agent was required). It is recognized that AFFF is more effective in fighting this type of fire than protein foam. If the regulation was changed to require AFFF instead of protein foam, only 10 airports would have to buy additional agent capability. The following list identifies each of these airports and the additional amount of agent needed.

JHW - Jamestown, NY	200 pounds dry chemical
ROC - Rochester, NY	1,000 gallons
CAK - Akron, OH	1,000 gallons
MRY - Monterey, CA	900 gallons
MOB - Mobile, AL	900 gallons
AGS - Augusta, GA	1,000 gallons
CHA - Chattanooga, TN	1,000 gallons
LAW - Lawton, OK	500 gallons
BPT - Beaumont, TX	700 gallons
FAT - Fresno, CA	300 gallons

Additionally, we feel that one 1,500 gallon CFR vehicle with AFFF would be the best alternative for the index A, AA, and B airports. This would effectively eliminate the need for index AA airports while reducing the manpower costs at index B airports and not increasing the manpower costs at index A, (this is due to the fact that a well designed CFR vehicle can be operated by one man). This is one area where costs can be reduced without a reduction of safety.

RESPONSE TIME

In section 2.3.3, HH Aerospace recommends that the response time should be lowered by requiring more firehouses.

We agree that reduced response times are required for more effective CFR, but we do not agree that the addition of more firehouses is the only answer. The primary areas on the airport that require protection are the runways and within 3,000 feet of the runway thresholds. Depending on airport layout, firehouse placement may or may not be the only answer. What is required is a change in the regulations (FAR Part 139) which would measure the required response time to the furthest point of the furthest runway rather than the midpoint of the runway. If relocation or addition of firehouses are required to achieve this goal, then they should be added.

RAPID INTERVENTION VEHICLES

HH Aerospace recommends in section 2.3.4 that greater use of Rapid Intervention Vehicles (RIVs) be considered. We agree with the concept of a single vehicle with RIV capability. As mentioned earlier, a 1,500 gallon RIV with one driver is a very effective and cost efficient approach to CFR for the smaller airports. Our only concern with using one truck for CFR is proper coverage during air carrier operations if the vehicle is out of service for maintenance. Under these conditions, suitable replacement vehicles (either mutual aid or reserve) should be available. If the primary CFR vehicle is to be out of service a replacement vehicle must be made available.

OVERRUN AREAS/ACCESS ROADS

In section 2.3.5, HH Aerospace recommends the FAA consider requiring enlarged overrun areas and better access roads; this Association agrees with this concept. Figure 8 shows the location of 80% of all air carrier accidents which occur on, or within, 3,000 feet of the active runway. Additionally, our statistics indicate that 35% of all fire deaths occur in the over/underrun zones. If these areas were cleared and improved, damage to the aircraft would be reduced and CFR response would be improved.

CFR TRAINING STANDARDS

In section 2.3.6, the contractor recommends that setting training standards should be considered; this is an absolute necessity. Aircraft rescue and fire fighting is a very specialized occupation. Our armed forces and most foreign governments have set training standards. The National Fire Protection Association (NFPA) has set minimum standards in NFPA 1003 (attachment 16). FAR Part 139, (i), is totally inadequate to deal with ensuring that training is done properly. While professional fire training schools do exist, there is no set curriculum and in many cases the training is inadequate. On page 44 in Volume 6 of the HH Aerospace Study, the contractor makes reference to the "little laboratory in Georgia" with reference to CFR training. The superintendent of the Georgia Fire Academy, Mr. Harold Thompson, reports dramatic improvement in the qualification and knowledge of CFR personnel in that state after a state law was passed requiring the CFR personnel to be trained to the standard contained in NFPA 1003 and certified as qualified CFR personnel. This experience certainly provides good information concerning the applicability of Federal training standards.

EMERGENCY MEDICAL TECHNICIANS

In section 2.3.7, the contractor recommends strong consideration of requiring Emergency Medical Technicians (EMT) at airports. This recommendation interfaces with the rescue/life saving aspects of CFR. The benefit of having some CFR personnel cross trained as EMTs is multifaceted. EMTs can help save victims of heart attack, seizures, etc. in the airport terminal. But the greatest benefit to be derived from their presence is during an airport disaster. They are knowledgeable in triage, rescue techniques, fire fighting and emergency first aid. Their presence is an absolute requirement if the life and safety of the passengers and crew at a given airport are of concern. We feel this is an excellent idea and should be incorporated in FAR Part 139.

AIP FUNDING BEYOND FAR PART 139 REQUIREMENTS

In section 2.3.8, the contractor recommends that ADAP (now AIP) be allowed to fund vehicles and firehouses beyond Part 139 requirements. This is acceptable since many airports have unique situations which demand facilities and equipment that exceed Part 139 requirements. A good guide for AIP funding levels is contained in advisory circular 150/5210-6B, "Aircraft Fire and Rescue Facilities and Extinguishing Agents". (attachment 17) Additionally, AIP funding must be available for training the CFR personnel.

AIP FUNDING OF MANPOWER

In section 2.3.9, the contractor recommends that AIP should be used to fund manpower costs. This is an extremely difficult proposal to accept without seeing many problems in administering such a program. We must reserve any endorsement of this recommendation until such time as a detailed plan has been devised to deal with the variety of problems associated with such a proposal.

CONCLUSIONS

The HH Aerospace cost/benefit study of CFR in the United States is a voluminous work with considerable amounts of data on the perceived costs and benefits of CFR. In ALPA's original statement of concern on this topic to the FAA (attachment 12), we stated, "This study has provided the FAA and industry with useful information and ideas. . .". This statement, as result of a more detailed review and analysis is no longer accurate. As discussed in this report, we find that the methods used for data acquisition, the basic assumptions made, and the final analysis used are all biased toward proving that CFR at the smaller airports is not cost effective or justified. ALPA's experience and research indicates that these airport CFR services are cost effective and justified.

The recommendations contained in the HH Aerospace Study contradicts completely the standards of the International Civil Aviation Organization, National Fire Protection Association, and the FAA's own recommended, and regulated, practices. Additionally, these recommended changes run counter to the Airport and Airways Act of 1970 that brought about the original regulations. This is of great concern to this Association.

On ALPA's original statement of concern, we recommended that ". . . the best way to approach this subject (CFR cost/benefit) is to discuss with industry their concepts on how to make CFR most efficient . . .. Industry has the knowledge and experience to interpret the data that HH Aerospace collected and make recommendations." ALPA's recommendation was not adopted by the FAA.[4]

Any policy changes concerning such a controversial topic as airport CFR will result in significant comments from the aviation industry. One element in the total question which has not received much attention is what the traveling public expects and what is required to meet, in a rational manner, those expectations. This element of the population should be encouraged to comment if the drastic recommendations (elimination of A, AA and B index CFR services) in the HH Aerospace Report are implemented.

There are many other inconsistencies, errors, and biases contained in the HH Aerospace Study which were not addressed in this statement of concern. We feel to address each and every one of these problems would require an effort as large and involved as the original study.

The recommendation to eliminate CFR services at index A, AA, and B index airports is a drastic and unrealistic recommendation. The proper approach, which was not addressed, is how can this service be made more cost efficient?

It is inconceivable to this Association that the HH Aerospace Study will be seriously considered by the FAA as a realistic and accurate research document. The findings of ALPA's research, outlined in this paper, indicate, that the HH Aerospace Study is seriously flawed and inaccurate. This Association strongly believes that any decision by the FAA to reduce CFR coverage based solely on the HH Aerospace Study would be irresponsible. The Air Line Pilots Association strongly encourages the FAA to review the accuracy of the HH Aerospace Study and to determine all of industries perspective prior to issuance of an NPRM dealing with FAR Part 139.

ENDNOTES

[1] Airport Crash/Fire/Rescue (CFR) Service Cost and Benefit Analysis, (Bedford, MA: HH Aerospace Design Co., Inc., 1978), Volume 1, p. 32.

[2] Ibid., p. 29.

[3] Ibid., p. 12.

[4] Letter from ALPA to William Shea, Associate Administrator for Airports, FAA, September 20, 1982, p. 5.

LISTING OF TABLES

Table Page

1 Manpower Costs to Meet FAR Part 139 Requirements

2 CFR Building Costs to Meet FAR Part 139 Requirements

3 CFR Equipment and Materials Costs to Meet FAR Part 139 Requirements

4 CFR Vehicle Cost by Airport Index and FAR Part 139 Requirements

5 Summary of Annual CFR Costs Required to Maintain FAR Part 139 Minimum Standards by Airport Index

6 Comparison of the Total Annual CFR Costs Estimated by HH Aerospace and the Costs of CFR to meet FAR Part 139 Requirements

7 Aircraft Size, Average Number of Seats Per Flight and Cost Per Seat for CFR Airport Index

8 Accident Location Chart

Table 1

MANPOWER COSTS TO FUND TO FAR PART 139 REQUIREMENTS

Index	Number of Airports	Shift Factors	Salary Per Man	Total Annual Cost	Per Airport
A	152	2	$17,022	$ 5,174,688	$ 34,044
AA	83	2	$17,022	$ 2,825,652	$ 34,044
B	73	2.5	$19,395	$ 7,079,175	$ 96,975
C	91	3	$22,837	$18,703,503	$205,533
D	26	3	$23,358	$ 5,465,772	$210,222
E	17	3	$23,925	$ 3,660,525	$215,325
TOTAL	442			$42,909,315	

* 1 man per truck - A, AA require 1 truck - B requires 2 trucks - C, D, E require 3 trucks

Table 2

CFR BUILDING COSTS TO FAR PART 139 REQUIREMENTS

Index	Number of Airports	Number of Vehicles	Cost/Vehicle/Year	Cost Per Airport Per Year	Cost for All Airports Per Year	ADAP Funding (80%) For All Airports
A	152	1	$2,000	$ 2,000	$ 304,000	$ 60,800
AA	83	1	$2,000	$ 2,000	$ 166,000	$ 33,200
B	73	2	$4,000	$ 8,000	$ 584,000	$116,800
C	91	3	$8,000	$24,000	$2,184,000	$436,800
D	26	3	$8,000	$24,000	$ 624,000	$124,800
E	17	3	$8,000	$24,000	$ 408,000	$ 81,600
TOTAL	442				$4,270,000	$854,000

Table 3

CFR EQUIPMENT AND MATERIALS - COSTS TO PART 139 REQUIREMENTS

Index	Number of Airports	Agent	Gear, Tools and Other	Total Per Man	Number of Men Required To Staff to Part 139	Total Cost Per Index Per Year	Total Cost Per Airport	Total Cost Per Airport Per Year at 80% ADAP Funding
A	152	$450	$200	$650	152	$ 98,800	$ 650	$ 19,760
AA	83	$450	$200	$650	83	$ 53,950	$ 650	$ 10,790
B	73	$503	$250	$753	146	$109,938	$1,506	$ 21,987
C	91	$556	$300	$856	273	$233,688	$2,568	$ 46,737
D	26	$631	$350	$981	78	$ 76,518	$2,943	$ 15,303
E	17	$706	$400	$1,106	51	$ 56,406	$3,318	$ 11,281
TOTAL	442					$629,300		$125,858

Costs based on figures found in Table 2.5 Volume 1, HH Aerospace Report and the minimum number of men required to fulfill FAR Part 139 requirements.

Table 4

CFR VEHICLE COST BY AIRPORT INDEX AND FAR PART 139 REQUIREMENTS

Index	Number of Airports	Total Vehicles	Cost of Vehicles New	Yearly Cost Total (1/15 new cost)	Cost, Yearly Per Airport (1/15 of Total)	Yearly Total Cost (1/15 of new cost) (80% ADAP Funding)	Yearly Costs Per Airport (1/15 Total) (80% ADAP Funding)
A	152	152 light wt. dry chem	$ 50,000 ea.	$ 506,000	$ 3,333	$101,333	$ 666
AA	83	83 light wt. dry chem/foam	$125,000 ea.	$ 691,666	$ 8,333	$138,333	$1,666
B	73	73 light wt. dry chem 73 1500 gal. foam	$ 50,000 ea. $200,000 ea.	$1,216,666	$16,666	$243,333	$3,333
C	91	91 light wt. dry chem 182 1500 gal. foam	$ 50,000 ea. $200,000 ea.	$2,730,000	$30,000	$546,000	$6,000
D	26	26 light wt. dry chem 52 2000 gal. foam	$ 50,000 ea. $220,000 ea.	$ 849,333	$32,666	$169,866	$6,533
E	17	17 light wt. dry chem 34 3000 gal. foam	$ 50,000 ea. $325,000 ea.	$ 793,333	$46,666	$158,666	$9,333
TOTAL	442			$6,787,664		$1,357,531	

Table 5

SUMMARY OF ANNUAL CFR COSTS TO MAINTAIN FAR PART 139 MINIMUM STANDARDS BY AIRPORT INDEX

Index	Manpower	Vehicles	Buildings	Equipment	Total by Index (without ADAP Funding)	Total by Index (With 80% AIP Funding) (Manpower not ADAP Eligible)
A	5,174,688	506,666	304,000	98,800	6,973,354 (12.56%)	5,356,581
AA	2,825,652	691,666	166,000	53,950	3,737,268 (6.73%)	3,007,975
B	7,079,175	1,226,666	584,000	109,938	8,989,779 (16.20%)	7,461,295
C	18,703,503	2,730,000	2,184,000	233,688	23,851,191 (42.98%)	19,733,041
D	5,465,772	849,333	624,000	76,518	7,015,623 (12.64%)	5,775,742
E	3,660,525	793,333	408,000	56,406	4,918,264 (8.86%)	3,912,072
TOTAL	42,909,315 (77.33%)	6,787,664 (12%)	4,207,000 (7.6%)	1,518,500 (2.7%)	55,485,479	45,246,707

Table 6

COMPARISON OF TOTAL ANNUAL CFR COSTS AS REPORTED BY HH AEROSPACE (VOLUME 1) AND THE COSTS TO PROVIDE CFR SERVICE TO FAR PART 139 MINIMUM STANDARDS

Index	Total Annual Costs As Reported by HH Aerospace	Total Annual Cost To Maintain FAR Part 139 Standard	Total Annual Cost to Airport Operator to Maintain Part 139 Standards with ADAP Funding (80%)	Difference Between A & B	Difference Between A & C
A	7,825,000	6,973,354	5,356,581	851,646	2,468,419
AA	7,058,000	3,737,268	3,007,975	3,320,732	4,050,025
B	12,411,000	8,989,779	7,461,295	3,421,221	4,949,705
C	42,111,000	23,851,191	19,733,041	18,259,809	22,377,959
D	20,313,000	7,015,623	5,775,742	13,297,377	14,537,258
E	22,368,000	4,918,264	3,912,072	17,449,736	18,455,928
TOTAL	115,321,000	55,485,479	45,246,707	59,835,521	70,074,293

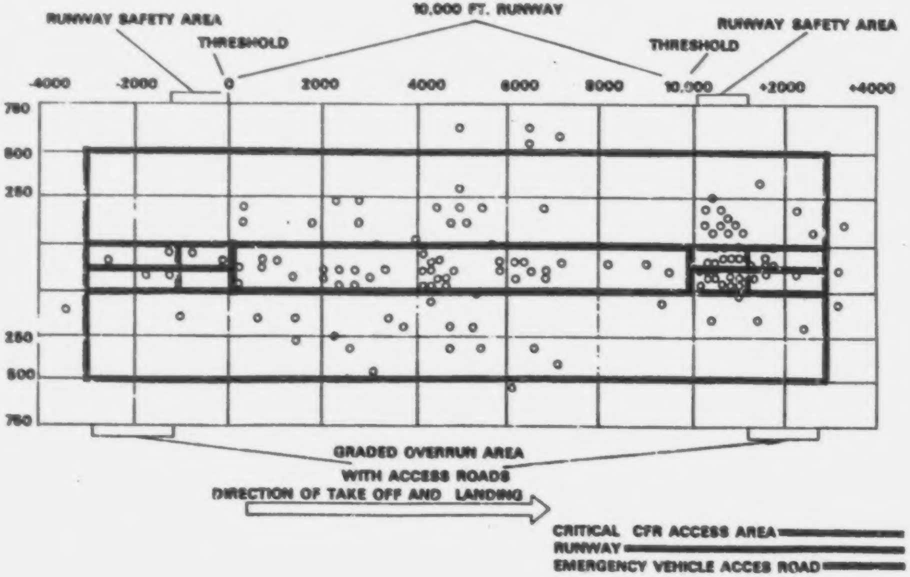
Table 7

INDEX AIRPORT AND AIRCRAFT SIZE

Index	Number of Airports Represented	Largest Aircraft	Average Number of Seats (All Aircraft)	Average Movements (All Aircraft)	HH Aerospace Cost Per Enplaned Passenger for CFR	Cost Per Passenger Seat for CFR Service
A	152	C-580	50	4 per day	4.19	.62
AA	83	DC-9	80	4 per day	3.44	.38
B	73	B-737	100	7.6 per day	1.53	.44
C	91	B-727-200	145	33.5 per day	.81	.12
D	26	DC-10 L-1011	250	152.38 per day	.25	.02
E	17	B-747	350	373 per day	.20	.01

Table 8

AIR LINE PILOTS ASSOCIATION
ACCIDENT LOCATION CHART
1964–1977



ALPA JANUARY 1978

NOT TO SCALE

LISTING OF ATTACHMENTS

Attachment

1 Dr. Austin Barrron's letter/report

2 HH Aerospace Report, Volume 1, Page 7

3 National Fire Protection Association, *Aircraft Rescue and Fire Fighting Services at Airports*; 403, Page 8

4 ICAO *Airport Services Manual*, Part I, Section 12.1.14

5 FAR Part 139(i)

6 United B-727 accident - accident report presently not available

7 NTSB Accident Report, Continental Air Lines, Inc. B-727 at Stapleton International Airport, August 7, 1975

8 Air Canada DC-9 Accident Report, Toronto, June 26, 1978

9 Partial listing of Turbine Powered Air Carrier Accidents from January 27, 1959 to December 8, 1965

10 ICAO ADREP - (Accident and damage report)

11 FAA CFR Response listing - 1974

12 ALPA's letter to Bill Shea, Associate Administrator of Airports, September 20, 1982

13 ALPA passenger survey of CFR costs

14 ALPA's survey, *Airport Fire and Rescue Facilities* , 1970, p. 2

15 HH Aerospace, Volume 5, p. 216

16 NFPA 1003

17 Advisory Circular 150/5210-6B

REFERENCES

Barron, Austin, PhD. Letter outlining his analysis of the HH Aerospace Design Company Cost/Benefit Analysis. Washington, DC, January 11, 1982.

Civil Aviation Authority. Aerodrome Fire and Rescue Services; A Report on the Regulations for Aerodrome Fire and Rescue Services by EASAMS Limited. London, May 1972.

Danielson, Richard E., A. B., M. T. (A.S.C.P.) and Reals, William, M.D., "Flight Fatalities Studied, Autopsy Investigation of Aircraft Accidents". Journal of the Kansas Medical Society, August, 1963.

Federal Aviation Administration. AC 150/5200-14, Results of 90-Day Trial Exercise on Fire Department Activity. Washington, DC, 1970.

Federal Aviation Regulations, Part 139. Certification and Operations: Land Airports Serving CAB-Certificated Air Carriers. Washington, DC: Federal Aviation Administration, 1974.

Federal Aviation Administration. Summary of Incidents Requiring Airport CFR Response. 1974

Graham, Lauren. "Research Into Post-Crash Fire." Aviation Engineering and Maintenance, October, 1977.

Hasbrook, Howard A., Garner, J. D., and Snow, Clyde C. Evacuation Pattern Analysis of a Survivable Commercial Aircraft Crash. Oklahoma City: Civil Aeromedical Research Institute, Federal Aviation Administration, 1982.

Hewes, Captain B. V. A Survey of Airport Fire and Rescue Facilities . Air Line Pilots Association, Washington, DC 1970.

HH Aerospace Design Company, Inc. Airport Crash/Fire/Rescue (CFR) Service and Cost and Benefit Analysis. Volumes 1-6. MA: Bedford, 1980.

Horeff, Thomas G. A Crashworthiness Analysis with Emphasis on the Fire Hazard: U.S. and Selected Foreign Turbine Aircraft Accidents 1964-1974. Report # FAA-RD-75-156. Washington, DC: Federal Aviation Administration, 1976.

ICAO Airport Services Manual, Part 1. Rescue and Fire Fighting. Document 9137-AN/898, 1977.

National Fire Protection Association. Aircraft Rescue and Fire Fighting Services at Airports, 403. 1978.

National Fire Protection Association. A Study of the FAA CFR Report by the HH Aerospace Design Company. 1982.

National Transportation Safety Board, Special Study. Cabin Safety in Large Transport Aircraft. Report # NTSB-AAS-81-2, 1981.

National Transportation Safety Board, Aircraft Accident Report. Continental Air Lines, Inc. Boeing 727-224, N88777 Stapleton International Airport. Report # NTSB-AAR-76-14, August 7, 1975.

National Transportation Safety Board, Special Report. Safety Aspects of Emergency Evacuations From Air Carrier Aircraft. Report # NTSB-AAS-74-3, November 13, 1974.

Pollard, Donell. Injuries in Air Transport Emergency Evacuations. Report # FAA-AM-79-6. Oklahoma City, OK: Federal Aviation Administration, 1979.

Sarkos, Constantine P., Hill, Richard G., Howell, Wayne D. "Wide-Body Test Article Employed to Study Post Crash Fuel Fires." ICAO Bulletin, 37, No. 10 (1982).

BEFORE THE

FEDERAL AVIATION ADMINISTRATOR

WASHINGTON, D.C.

In the Matter of Proposals Concerning:

14 CFR Part 1 - Definitions

14 CFR Part 25 - Airworthiness Standards - Transport Category Airplanes

14 CFR Part 121 - Certification and Operation: Domestic, Flag and Supplemental Air Carriers and Commercial Operators of Large Aircraft

14 CFR Part 139 - Certification and Operation: Land Airports Serving CAB Certified Air Carriers

PETITION OF THE AIR LINE PILOTS ASSOCIATION, INTERNATIONAL

Communications with respect to this document should be sent to:

Mr. John E. O'Brien
Manager-Engineering and Operations

Mr. Richard W. Clarke
Staff Engineer-Engineering

Engineering & Air Safety Department
Air Line Pilots Association, Int'l.
1625 Massachusetts Avenue, N.W.
Washington, D.C. 20036

Telephone: (202) 797-4191

Dated: December 17, 1980

Based upon this review, ALPA concludes that existing FAA requirements and terminology relating to water survival do not accurately reflect the needs of current transport aviation experience and should be refined to meet these needs. Further, ALPA finds that several areas which are critical to promoting survival of intentional or unintentional water contacts are not addressed by the FAA.

The Air Line Pilots Association, representing the interests of 33,000 air carrier pilots whose profession commits them to furtherance of aviation safety, has a well-known and long-standing interest in refining and improving regulations and guidance material which aid in preventing aircraft accidents and which promote accident survival of passengers and crewmembers. Therefore, in the public interest, ALPA requests that 14 CFR, Parts 1, 25, 121, and 139 be amended in the manner suggested below and that the various other actions requested of the Administrator, which follow, be carried out in the appropriate manner:

PROPOSED AMENDMENTS

1. FAR 1.1 General definitions. Redefine "Extended over-water operation...with respect to aircraft other than helicopters" to read:

> "Operation overwater outside coverage of ATC radar or overwater in areas where Search and Rescue efforts could not assure removal of accident survivors from the water in less than one hour."

A new definition should be incorporated entitled "Restricted overwater operation" and should read:

> "Operation overwater within ATC radar coverage or operation from airports bounded by significant bodies of water."

2. FAR 25.801 Ditching. Rename this Section "Controlled Water Contact"

Amend paragraph (b) to read:

> "Each practical design measure, compatible with the general characteristics of the airplane, must be taken to minimize the probability that in a planned emergency landing on water or unplanned controlled water contact, the behavior of the airplane......."

Amend paragraph (c) to read:

> "The probable behavior of the airplane in a planned or unplanned water landing must be investigated by model tests or by comparison with airplanes of similar configuration for which the water landing characteristics are known...."

3. FAR 25.1411 General

Amend paragraph (d)(1) to read:

> "The storage provisions for the water survival equipment described in 25.1415 must accommodate enough rafts for the maximum number of occupants for which certification for planned and unplanned water landing is requested."

Amend (d)(2) to reflect certification for both planned and unplanned water landings.

Amend paragraph (f) to reflect use in planned and unplanned water landings and to require storage of life preservers in a location above the seat bottom cushion which would permit donning of the life preserver in fifteen seconds by a seated passenger.

4. FAR 25.1415 Ditching Equipment

Rename this section "Water Survival Equipment" and substitute this terminology, throughout, in place of "ditching equipment."

Amend paragraph (e) to read:

> "For airplanes certificated for restricted overwater operation and not certificated in accordance with 25.801, there must be approved life preservers and secondary flotation equipment to permit each occupant to keep the trunk of the body out of the water. These means must be within easy reach of each seated occupant and must be readily removable from the airplane."

5. FAR 121.339 Emergency Equipment for Extended Overwater Operations

Amend 121.339 to delete the word "extended" in the title and to align the text with overwater operation definitions proposed above. Equipment for extended overwater operation would remain the same and all references to "ditching" would be changed to "planned or unplanned water landing."

Paragraph (a)(3) would be amended to describe what equipment features constitute a pyrotechnic signaling device suitable for use in rafts in the water.

Further amendment to the text should be made to specify that air carriers operating in restricted overwater operations should be equipped with water survival equipment adequate to keep occupants out of the water when operating in areas and at times when the water temperature is known to be below 53 degrees F.

6. FAR 121.340 Emergency Flotation Means:

The current text permitting substitution of "approved flotation means" for life preservers should be changed to eliminate the option and to require both. Further, the text should require that life preservers be located above the level of the seat bottom cushion. Stipulation should also be made that life preservers must be supplemented with rafts or flotation platforms when water temperature is known to be below 53 degrees F.

7. FAR 139.49 - Airport Firefighting and Rescue Equipment and Service

Add a new paragraph (j) to read:

Airports located adjacent to significant bodies of water must maintain or have available adequate water rescue equipment to retrieve the occupants of the largest aircraft operating from that airport and to permit response of 50% of this equipment to a water area within two thousand feet of the active runway threshold within ten minutes of dispatch.

8. FAR 139.55 Emergency Plan

Amend paragraph (a) to require prompt response both on the airport and in water areas adjacent to the airport.

Amend paragraph (iii) to include water vehicles.

OTHER PROPOSALS

1. Technical Standards Orders (TSOs)

Develop, or adopt from appropriate material, a TSO describing requirements for pyrotechnic signaling devices intended for use in rafts or in the water.

Amend existing TSOs on escape slides to include design features making slides suitable as rudimentary rafts for flights conducted in restricted overwater operations.

Amend the existing TSO on lifevests to require simplified retaining systems permitting donning by a seated passenger within fifteen seconds.

2. Advisory Circulars

Develop an Advisory Circular describing coastal surface water temperatures and establishing water survival zones based upon water temperatures less than 53 degrees F.

ARGUMENTS IN SUPPORT OF THE PROPOSED ACTIONS

I

WATER SURVIVAL TRENDS

Since the advent of turbine-powered, large transport aircraft, the nature of unplanned water landings has changed from a primary threat of open ocean survival to that of survival within relatively close reach of rescue resources. The Association feels that current requirements for extended overwater operations must be retained to account for the self-sufficiency necessary in an open ocean survival situation; however, it is the Association's opinion that accident trends and increased pressure for change by operators of large aircraft make it necessary to review and revise water survival equipment for restricted operations taking place near shore or during departure from and approach to airports located near significant bodies of water.

Attachment 2 represents an analysis of the location of recent transport aircraft accidents in relation to the active runway. This, in turn, should be compared to Tables 1 and 2 of Attachment 3 to arrive at an understanding of the potential for transport aircraft making an unplanned water landing while relatively close to the arrival or departure airport. Table 3 of Attachment 3 confirms the trend for water-located accidents, involving turbine-powered transports, to occur in airport terminal areas.

II

PHYSIOLOGY

A large body of literature exists, in addition to FAA studies, that describes the parameters of human survival in the water. Attachment 4 is offered as a good, current example of water survival research. To summarize current research, it appears that if a body's core temperature drops to 30-35 degrees C, death is highly likely due to the subject's inability to participate in his or her own rescue. Some dexterity of the hands is retained at a hand temperature of 10 degrees C. In research carried out by the University of Victoria in British Columbia, Canada, a healthy male subject clad in jeans, cotton shirt, underwear, socks, tennis shoes, and life vest was immersed in 52 degree F (11 degree C) water. This subject showed a 2.3 degree C rectal temperature drop per hour;[1] thus, at this temperature lapse rate, between one and two hours could be the expected time for the subject's normal 37 degree C core temperature to drop to the 30-35 degree C range mentioned above. Thinner, smaller, or less healthy subjects would show an increased cooling rate and decreased survival time.

Based upon extracts from the National Search and Rescue Manual used by the U.S. Coast Guard, the border of the "safe" zone for water immersion is one hour at 53 degree F water temperature (Attachment 5). When correlated with the Air Force System, Command Design Handbook DH 2-8 table on probability of water survival (Attachment 6, sub-note 2 (4)) it can be seen that this temperature-time combination offers a probability of 1.0 of survival for one hour. Again, this figure is for healthy, young males; therefore, this probability would provide conceptual room for error for less fit or smaller individuals.

---

[1] "Survival Suits for Accidental Immersion in Cold Water - Design Concepts"; University of Victoria Department of Biology, Victoria, British Columbia, Canada, V8X2Y2.

All the information above must be viewed in the context of the number of U.S. airports located near water which is at or below 53 degrees F during winter months or for longer periods. Further, several U.S. air carriers are currently permitted to operate in areas such as the Alaskan and continental U.S. west coasts where water is often below this temperature.

In seeking to establish a temperature/time criterion for use of water survival equipment, ALPA has attempted to be conservative; however, additional public, academic, and industry comment may suggest higher temperatures as a more appropriate criterion based upon more detailed knowledge of physiology or survival experience.

III

MARITIME SEARCH AND RESCUE CAPABILITY

Any planning and regulatory activity concerning water survival must account for Search and Rescue (SAR) resources and capabilities. To that end, Attachment 7 is a description of the airborne SAR capabilities of the Coast Guard and the location of the aircraft. It will be noted that these aircraft can retrieve a very limited number of people from the water; the primary means of aid is dropping of rafts. Further, a one- to two-hour delay can be expected for a Coast Guard aircraft to arrive at an accident scene to retrieve survivors or drop rafts. This capability is augmented, to a limited degree, by Navy patrol aircraft which can drop two seven-person rafts on approximately two to four hours notice and by H-46 helicopters at a limited number of naval air stations; the H-46 has a similar capability to the HH-3 flown by the Coast Guard. Short-term rescue by surface vessel cannot be counted upon due to the slowness of response.

It is the Association's opinion that in areas close to the shore of the continental U.S., and in a limited number of other areas, ATC radar coverage would permit direction of rescue resources to the aid of a transport aircraft which had been operating under positive control prior to an accident within the radar coverage area. In such a case, ALPA feels that selective minimization of water survival equipment is appropriate based upon the required ability to locate an accident site and to supplement survival resources by air-drop within one hour of occurrence. Such equipment minimization must retain flotation platforms as a base since the primary survival need in water is to keep the body out of the water. This delays onset of hypothermia and inhibits the activity of aggressive marine life.

Water survival equipment requirements must not exist without reflecting the physiologic needs of accident survivors and the rescue capability of the air transportation system.

IV

AIRPORT WATER RESCUE CAPABILITY

Though some airports in the U.S., which are located adjacent to water, do have water rescue plans and equipment, such is not the case generally. Attachment 8 is provided to illustrate a typical, good quality airport emergency plan, in this case for Washington National Airport. Review of the contents and text reveals only one short section describing the potential need to contact harbor police in event of unspecified need; the telephone numbers or radio frequencies for the harbor police are not listed. Further, all the planning maps illustrate land areas adjacent to the airport; water areas are carefully excluded. This failing of the airport's emergency plan is reflected in its water rescue capability.

In 1978, a water rescue drill was carried out at Washington National Airport and was a stark contrast to the well-planned and coordinated land rescue exercise carried out in 1977. National Airport's water rescue equipment and training were minimal and ineffective; further, there was little coordination with nearby water rescue resources such as the harbor police. The Coast Guard is not equipped for nor available for water rescue at National Airport.

National Airport is typical in this respect since its planned resources comply with current regulations. Current requirements of 14 CFR Part 139 entirely overlook the need for water rescue capability at airports located adjacent to water.

Thus it is in the public interest that Part 139 be amended to include provision for water rescue.

V

REVISION OF FAA TERMINOLOGY

During the past three years, much discussion has taken place between the FAA and various segments of the aviation industry concerning incidence of water survival situations involving aircraft. While this Association and other parties have generally construed the term "ditching" to include all cases of landplanes alighting in the water either by accident or intent and either with or without preparation, the FAA has uniformly interpreted "ditching" to mean planned water contact after full preparation. Based upon these differing interpretations, confusion has been fostered concerning the problem. If ditching is to be interpreted as the FAA has consistently done, the regulatory language appropriate to water survival must be made specific and must relate to both planned and unplanned circumstances. The term "ditching" is inadequate for this purpose.

VI

FLOTATION EQUIPMENT

Attachment 9 illustrates the floating position of an average male test subject properly using a standard airline seat flotation cushion. It must be noted that the subject's mouth and nose are barely above water and that the reclining position is extremely insecure. Further, it should be noted that virtually no passenger information card in use by airlines illustrates this floating position. Generally, information card illustrations portray the passenger floating in a vertical position with shoulders out of the water. One card shows a passenger floating on her stomach with the cushion beneath her chin, with her head and shoulders fully out of water. Attachment 9 illustrates the actual floating position as well as the very marginal flotation of the waterlogged cushion. For this reason, it is requested that passenger information cards be changed to accurately reflect experience and minimize passengers' surprise at their inability to float according to expectation.

Attachment 9 also illustrates the need for alternative flotation devices that better meet the passenger's true survival needs. Attachments 10 A and B are provided as an example of one alternative concept. It is necessary that the FAA take action both in research and in regulatory activity to develop functional flotation devices that are compatible with the aircraft cabin. In line with this activity, the FAA must develop Advisory Circular guidance on surface water temperatures and geographical locations which may be used by aircraft operators to determine water survival equipment needs.

VII

PYROTECHNIC SIGNALING DEVICES

No FAA guidance exists regarding design or operation of pyrotechnic signaling devices despite use of the word "approved" in the regulation. Due to this oversight, one aircraft operator equipped its aircraft with highway flares which were clearly labeled with prohibitions against holding in the hand and which could not be ignited in the water. Though this ludicrous skirting of regulatory intent has since been eliminated, no regulatory guidelines have yet been adopted. This is true despite more than forty years military experience with pyrotechnic signaling devices and the existence of complete specifications for their design and use. A Technical Standard Order (TSO) must be adopted to correct this failure to provide proper guidance to civil aircraft operators.

In summary, perhaps the best illustration of water rescue complexity and survival involves the recent rescue of the passengers and crew of the cruise ship Prinsendam. Attachments 11A, 11B, and 11C summarize the time delays involved in mounting an air/sea rescue effort and the resources that were brought to bear in rescuing 510 people from Alaskan coastal waters. In particular, it must be noted that all the Prinsendam's complement were able to leave the ship in boats and were airlifted to rescue vessels. No one entered the 57 degree F water and all survived a rescue effort that consumed several hours. This would not be the case in an aviation accident occurring in the water due to existing deficiencies in planning, preparation, and equipment.

CONCLUSION

For the foregoing reasons, the public's interests would be best served by a comprehensive FAA program aimed at revision of water survival equipment requirements. This petition should be used as the basis for that effort.

Respectfully submitted,

John E. O'Brien
Manager, Engineering and Operations

R. Clarke
R. W. Clarke
Staff Engineer

Engineering and Air Safety Department
Air Line Pilots Association, International
1625 Massachusetts Avenue, N.W.
Washington, D.C. 20036

Dated in Washington, D.C.
this 17th day of December, 1980

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
WASHINGTON, D.C. 20591

RECEIVED
DEC 06 1982
ENGINEERING & AIR SAFETY DEPARTMENT

* *

In the matter of the petition of
AIR LINE PILOTS ASSOCIATION
for rulemaking to amend Parts 1, 25, 121, and 139 of the Federal Aviation Regulations

* *

Regulatory Docket No. 21222

DENIAL OF PETITION

By letter dated December 17, 1980, Mr. John E. O'Brien, Manager, Engineering and Operations, Engineering and Air Safety Department, Air Line Pilots Association (ALPA), 1625 Massachusetts Avenue, NW., Washington, D.C. 20036, petitioned to amend various sections of Parts 1, 25, 121, and 139 of the Federal Aviation Regulations (FAR) to improve the survivability of aircraft in accidents resulting from intentional or unintentional water contact. The supporting information in the petition was supplemented by a letter dated June 3, 1981, from Mr. Joseph M. Schwind, Deputy Manager-Engineering, ALPA.

Sections of the FAR affected:

FAR Part 1 —

The petitioner proposes to redefine the term "extended over-water operation," with respect to aircraft other than helicopters, as an operation over water outside coverage of air traffic control (ATC) radar or over water in areas where search-and-rescue efforts could not ensure removal of accident survivors from the water in less than 1 hour. Part 1 currently defines this term as an operation over water at a horizontal distance of more than 50 nautical miles from the nearest shoreline. The petitioner also proposes to establish in Part 1 the new term, "restricted over-water operation," defined as an operation over water within ATC radar coverage or operation from airports bounded by significant bodies of water.

FAR Section 25.801 —

The petitioner proposes to change the title of § 25.801 from "Ditching" to "Controlled water contact." The petitioner also proposes to revise

§ 25.801(b) to read: "Each practical design measure, compatible with the general characteristics of the airplane, must be taken to minimize the probability that in a planned emergency landing on water or unplanned controlled water contact, the behavior of the airplane . . . [unchanged] . . . ." Section 25.801(b) currently reads: "Each practicable design measure, compatible with the general characteristics of the airplane, must be taken to minimize the probability that in an emergency landing on water, the behavior of the airplane would cause immediate injury to the occupants or would make it impossible for them to escape."

In addition, the petitioner proposes to revise § 25.801(c) to read: "The probable behavior of the airplane in a planned or unplanned water landing must be investigated by model tests or by comparison with airplanes of similar configuration for which the water landing characteristics are known . . . [unchanged] . . . ." Section 25.801(c) currently reads: "The probable behavior of the airplane in a water landing must be investigated by model tests or by comparison with airplanes of similar configuration for which the ditching characteristics are known. Scoops, flaps, projections, and any other factor likely to affect the hydrodynamic characteristics of the airplane, must be considered."

<ins>FAR Section 25.1411</ins> —

The petitioner proposes to revise § 25.1411(d)(1) to read: "The storage provisions for the water survival equipment described in § 25.1415 must accommodate enough rafts for the maximum number of occupants for which certification for planned and unplanned water landing is requested." Section 25.1411(d)(1) currently reads: "The stowage provisions for the liferafts described in § 25.1415 must accommodate enough rafts for the maximum number of occupants for which certification for ditching is requested."

The petitioner also proposes to revise § 25.1411(d)(2) to reflect certification for both planned and unplanned water landings.
Section 25.1411(d)(2) currently reads: "Liferafts must be stowed near exits through which the rafts can be launched during an unplanned ditching."

In addition, the petitioner proposes to revise § 25.1411(f) to reflect use of life preservers in planned and unplanned water landings and to require storage of life preservers in a location above the seat bottom cushion which would permit donning of the life preserver in 15 seconds by a seated passenger.

Section 25.1411(f) currently reads: "The stowage provisions for life perservers described in § 25.1415 must accommodate one life preserver for each occupant for which certification for ditching is requested. Each life preserver must be within easy reach of each seated occupant."

<ins>FAR Section 25.1415</ins> —

The petitioner proposes to retitle § 25.1415 as "Water survival equipment" and substitute this terminology throughout the section in place of the currently used title and term "Ditching equipment."

The petitioner also proposes to revise § 25.1415(e) to read: "For airplanes certificated for restricted overwater operation and not certificated in accordance with § 25.801, there must be approved life preservers and secondary flotation equipment to permit each occupant to keep the trunk of the body out of the water. These means must be within easy reach of each seated occupant and must be readily removable from the airplane." Section 25.1415(e) currently reads: "For airplanes not certificated for ditching under § 25.801 and not having approved life preservers, there must be an approved flotation means for each occupant. This means must be within easy reach of each seated occupant and must be readily removable from the airplane."

FAR Section 121.339 —

The petitioner proposes to delete the term "extended" in the title and align the text of the section with the overwater operation definitions proposed as amendments for Part 1. Equipment for extended overwater operation would remain the same, and all references to "ditching" would be changed to "planned or unplanned water landing."

The petitioner also proposes to revise § 121.339 to require that air carrier airplanes operating in restricted overwater operations (as defined in the proposed amendments of Part 1) be equipped with water survival equipment adequate to keep occupants out of the water when operating in areas, and at times, when the water temperature is known to be below 53 degrees F.

In addition, the petitioner proposes to revise § 121.339(a)(3) to describe pyrotechnic signaling devices suitable for use in rafts in the water. Section 121.339(a)(3) currently requires that at least one pyrotechnic signaling device be carried in the airplane for each liferaft.

FAR Section 121.340 —

The petitioner proposes to revise § 121.340 to eliminate the option for either a life preserver or an approved flotation means and to require the carriage of both a life preserver and an approved flotation means for each occupant. Also, the petitioner proposes to revise § 121.340 to require that life preservers be located above the level of the seat bottom cushion, and that life preservers be supplemented with rafts or flotation platforms when the water temperature is known to be below 53 degrees F.

FAR Section 139.49 —

The petitioner proposes to revise § 139.49 by adding a new paragraph to read: "Airports located adjacent to significant bodies of water must maintain or have available adequate water rescue equipment to retrieve the occupants of the largest aircraft operating from that airport and to permit response of 50 percent of this equipment to a water area within 2,000 feet of the active runway threshold within 10 minutes of dispatch."

FAR Section 139.55 —

Section 139.55 requires that an emergency plan be established that ensures prompt response to emergencies and unusual conditions on the airport. This section requires, in part, that the emergency plan provide, to the extent practicable, for transportation and medical assistance for the maximum number of persons that can be carried on board the largest air carrier aircraft the airport reasonably can be expected to serve. The emergency plan must contain a list of surface vehicles and aircraft that are intended to provide transportation for injured and deceased persons following an airport disaster. The petitioner proposes to revise § 139.55 to require that the emergency plan ensure prompt response both on the airport and in water areas adjacent to the airport. Also, the petitioner proposes to revise § 139.55(b)(2)(iii) to require that water vehicles be added to the list of surface vehicles and aircraft designated for medical transportation.

In addition to the changes to the above sections, the petitioner seeks the following actions:

Establish a technical standard order (TSO) describing requirements for pyrotechnic signaling devices intended for use in rafts or in the water.

Revise existing TSO's on escape slides to include design features making slides suitable as rudimentary rafts for flights conducted in restricted overwater operations.

Revise the existing TSO on lifevests to require simplified retaining systems permitting donning by a seated passenger within 15 seconds.

Develop an advisory circular describing coastal surface water temperatures and establishing water survival zones based upon water temperatures less than 53 degrees F.

The petitioner's supportive information is as follows:

There has been controversy concerning requests of some air carriers to delete liferafts from emergency equipment for operation beyond 50 nautical miles from shore. There were survival problems common to the unintentional water contact of a B-727 in Escambia Bay near Pensacola, Florida, on May 8, 1978, and a planned ditching of a DC-9 near St. Croix, Virgin Islands, on May 2, 1970. A review of available information on water survival provisions for occupants of transport aircraft indicates that existing requirements and terminology in FAA safety regulations do not meet the water survival needs of current transport aviation as reflected by service experience. Several areas which are critical to survival following intentional or unintentional water contacts are not addressed by FAA requirements. The FAR should be revised to address both intentional and unintentional water contact since the term "ditching," now used in the FAR, refers only to intentional water contact. Public interest will be served by a comprehensive FAA program aimed at revision of water survival equipment requirements.

Since the advent of turbine-powered air carrier airplanes, from the standpoint of occupant survival in water, the threat of an unplanned landing in water relatively close to rescue resources has become the predominant consideration as compared to the threat of a landing in the open ocean far from land. The current airworthiness and operational requirements for extended overwater operations are necessary to ensure the self-sufficiency needed for open-ocean survival. Accident trends and increased pressure for change by operators make it necessary to revise water survival equipment requirements for restricted operations near shore or during departure from or approach to airports located near significant bodies of water. (The petitioner does not indicate the nature of the change on the part of operators.)

The petitioner contends that experience has shown that most air carrier accidents occur during either the takeoff or approach/landing phase of flight. About 15 percent occur en route. There has been only one planned ditching of an air carrier jet transport, which was the St. Croix accident.

Four charts submitted with the petition indicate the potential of transport airplanes making an unplanned water landing close to the arrival or departure airport. One chart depicts accident locations relative to the hypothetical 10,000-foot runway and direction of flight for the period 1964 through 1977. Two charts depict the potential water hazards in the runway overrun areas and the approach and departure areas of U.S. terminal airports. One chart compiles brief descriptions of 42 jet transport accidents worldwide involving water contact during the period 1959 through 1979.

There is much literature on immersion hypothermia and human survival in water. Submitted with the petition is the current research report, "Physiological Response of Human Subjects Wearing Thermal Protective Clothing Assemblies in Varying Environments," prepared by the Naval Air Development Center. In summary, current research indicates that if human body core temperature drops to 30-35 degrees C, death is likely due to the subject's inability to participate in his or her own rescue. Some dexterity of the hands is retained at 10 degrees C. In one research project, a lightly clothed male subject in 11 degrees C water had a 2.3 degree C per hour drop in rectal temperature. At this rate, after 1 to 2 hours, the subject's temperature could be expected to become critically low. Thinner, smaller, or less healthy subjects would have a decreased survival time.

The U.S. Coast Guard National Search and Rescue Manual indicates the "safe" border is 1 hour in 11 degree C (53 degree F) water. When correlated with the Air Force System Command Design Handbook DH 2-8 table on probability of water survival, this temperature-time combination offers a probability of 1.0 of survival for 1 hour (for healthy, young males).

The petitioner submitted a survivability chart reportedly agreed on by most members of the Society of Automotive Engineers Committee S-9, Cabin Safety Provisions. This chart shows: at 32 degree F water temperature, 50 percent of the survivors die within 10 minutes and 99 percent of the survivors are dead within 1 hour and 20 minutes; at 41 degrees F, 50 percent die within 20 minutes and 99 percent are dead within 2 hours and 15 minutes; at 50 degrees F, 50 percent die within 30 minutes and 99 percent are dead within 3 hours and 20 minutes; above 68 degrees F, likelihood of shark attack increases.

The information above is presented in context with the number of U.S. airports located near water at or below 53 degrees F during winter or longer periods. Several U.S. air carriers operate over water which is often below this temperature. The above temperature/time criterion is conservative, and public comment may suggest a higher temperature criterion based upon better knowledge of physiology or survival experience.

In water accidents, kerosene might be released and float on the water near survivors. Kerosene ingestion is just as dangerous as hypothermia. Following the accident in Escambia Bay, the Civil Aeromedical Institute experimented with white rats and found that under certain experimental conditions kerosene on water reduced the time of survival to one-fourth to one-sixth that of rats swimming in clear water. Kerosene might have caused the deaths of three victims in Escambia Bay, all of whom were expert swimmers.

Planning and regulations for water survival must account for search and rescue (SAR). Submitted with the petition is a description of the Coast Guard's airborne SAR capabilities and the location of its aircraft. These aircraft can rescue a limited number of people, primarily by dropping rafts. Coast Guard aircraft can be expected to need 1 to 2 hours to reach an accident scene. Coast Guard SAR is augmented somewhat by Navy patrol aircraft, which can drop 2 seven-person rafts on a 2- to 4-hour notice, and by H-46 helicopters at a few naval air stations. In areas close to the shore of the continental United States and in certain other areas, ATC radar would permit direction of rescue to a transport aircraft operating under positive radar control prior to an accident. In such case, airborne water survival equipment can be selectively minimized based upon the required ability to locate an accident site and airdrop supplemental equipment within 1 hour of the accident. Minimum equipment must include flotation platforms to keep the body out of the water to delay hypothermia and protect survivors from aggressive marine life.

Though some U.S. airports near water have water rescue plans and equipment, such is not the general case. Submitted with the petition is the Washington National Airport emergency plan, as an example of a typical good plan. This plan contains one short section on contacting harbor police in the event of unspecified need. Telephone numbers or radio frequencies for harbor police are not listed. Planning maps illustrate land areas adjacent to the airport. Water areas are excluded. This deficiency in the emergency plan is reflected in the water rescue capability of the airport. The 1978 water rescue drill at National Airport contrasted with the well-planned and coordinated 1977 land rescue drill. Airport water rescue equipment and training were minimal and ineffective, and there was little coordination with nearby rescue resources such as the harbor police. National Airport is typical since it complies with current regulations. Part 139 entirely overlooks water rescue.

Part 25 requires that an airplane not equipped with life preservers be equipped with flotation devices. These devices are generally seat cushions and are inadequate for survival. Cushions lose buoyancy in about 15 minutes. An improved device should be developed, through FAA research, if necessary. Submitted with the petition is a photograph of an average male subject in still water using a device similar to those used by air carriers. The photo shows the subject assuming the natural chest-up reclining position, holding the device to his chest, with the back of his head submerged and his nose and mouth barely above water. This reclining position is insecure and critical from the standpoints of hypothermia and water ingestion. Also submitted with the petition are photographs of newly designed possible alternative devices. One is an inflatable one-person flotation platform to keep the upper torso out of water. The other is a quick-donning lifevest.

Virtually no passenger information card used by air carriers illustrates the inclined position a survivor will naturally assume when using a flotation cushion. Generally, cards show the passenger floating vertically with shoulders out of the water. One card shows a passenger floating on her stomach with the cushion beneath her chin, with head and shoulders fully out of water. Passenger information cards should be changed to reflect experience and minimize passengers' surprise at their inability to float according to expectation.

Many air carriers stow lifevests under seats. During water impact, these seats tend to collapse and make lifevests inaccessible. Lifevests should be stowed in seat backs. Submitted with the petition is a photograph of a possible seat back stowage compartment. Seat back stowage would improve accessibility and help prevent pilferage, which is reported as very frequent in air carrier service.

The most logical solution to the water survival problem is to equip all aircraft with slide rafts or rapidly deployable flotation equipment to keep everyone out of the water, especially the handicapped and the aged. The slide raft does add weight to the aircraft; however, to offset this weight, the emergency pack currently required for liferafts could be eliminated since it is of little use except for an extended period of survival. The pack of course would be required for extended overwater flight.

Although the FAA requires the use of approved pyrotechnic signaling devices, no FAA guidance exists on design or operation of these devices. Due to this, one operator equipped its aircraft with highway flares labeled with prohibitions against holding in the hand and which could not be ignited in water. Though this is an example of skirting regulatory intent, no regulatory guidelines have been established. This particular case was corrected. There are more than 40 years of military experience with pyrotechnic signaling devices, and specifications exist for their design and use. A TSO should be established for these devices.

An illustration of water rescue complexity and survival is the recent rescue of the passengers and crew of the cruise ship Prinsendam. A fire occurred on board the ship. Submitted with the petition are the telegraphic status reports of the fire and rescue efforts which lasted several hours. These reports summarize delays in mounting an air/sea rescue and the resources that were needed in rescuing 510 people from Alaskan coastal waters. All of the Prinsendam's complement left the ship in boats and were airlifted to rescue vessels. All survived and no one entered the 57 degree F water. This would not be the case in an aviation accident due to existing deficiences in planning, preparation, and equipment.

A summary of the ALPA petition was published in the Federal Register on March 30, 1981 (46 FR 19245).

Comments on the petition:

Numerous commenters support the general objective of improving both airborne and waterborne rescue capability to increase survivability in aircraft water accidents. Many support the ALPA regulatory proposals or a comprehensive program to improve survivability, or both. Numerous comments are from individuals, indicating broad popular support from the general public.

Concerning the proposal to amend Part 1, numerous commenters support, without substantial comment, the revision of basic definitions proposed in the petition.

Regarding accident experience as it pertains to basic definitions and objectives in the petition, several commenters agree that an unplanned accident near land is much more probable than a planned ditching in open sea. No commenter opposes this basic position.

Several commenters point out that in the 42 accidents cited, the petitioner fails to distinguish between the survivable and the nonsurvivable and to identify those in which the proposals would have affected survivability.

One commenter analyzes the 14 accidents involving U.S. carriers and concludes: 2 involved turboprops not comparable to turbojets; 3 involved runway overruns, not extended overwater flight; 3 involved uncontrolled impacts and were not survivable; 3 involved inadvertent controlled descent with destruction on impact; 1 did not come to rest in water; and 2 had some type of water survival gear which was relatively ineffective. The commenter states that the accidents verify that only on rare occasions may there be a need for flotation equipment and that they do not establish a need for flotation equipment for extended overwater flight. The commenter states that since the early 1950's, jet transports of the free world have flown approximately 175 million hours, 91 million by U.S. carriers, and that there has never been a case in which a commercially operated jet transport has attempted an intentional controlled ditching. The commenter states that in 22 years of jet operation, the need for all of the emergency equipment for extended overwater operations specified in § 121.399 has not been verified.

Another commenter similarly discusses the absence of planned ditchings. The commenter states that in jet airline operations there have been over 40 water-impact accidents and that, except for the St. Croix accident, all have been unintentional water contacts within 14 miles of land. The commenter contends that FAA regulations require airlines to prepare for a type of accident which has never occurred in jets and not to prepare for the type which has occurred.

One commenter states that no data base is shown for the accident location chart in the supporting data and that there is no definition of a "significant" body of water.

One commenter, opposed to the changes in basic definitions of Part 1, agrees with the petitioner that existing requirements and terminology on water survival do not reflect the needs of transport aviation and should be refined.

In opposition to the petition, the commenter states that the present definitions regarding extended over-water operation were developed 30 years ago based on airplanes at that time and do not reflect the improved safety and reliability of aircraft, engines, systems, and equipment in current service over that which existed when the regulations were developed.

The commenter states that the revised definition of "extended over-water operation" would be imprecise and difficult to administer and that although the present definition is outmoded, it is definable and usable by a crew in flight. The commenter questions how to present to a pilot information on the flight area falling within ATC radar coverage and how this information would be updated if a radar system becomes inoperative. The commenter questions the definition of search and rescue organizations. The commenter estimates that the new definition would increase the number of air carrier operations defined as "extended overwater" with the accompanying equipment requirements and points out that ICAO permits operation up to 400 nautical miles or 120 minutes at cruising speed, whichever is less, offshore without the carriage of liferafts. The commenter states that the definition of "restricted over-water operation" is imprecise and that no definition of "significant bodies of water" is offered. The commenter states that the proposed changes could require every airplane to have life preservers, approved flotation means, and, depending on airport location and time of year, liferafts or flotation platforms, because there is no practical way to schedule only certain airplanes for operation over water and into specific stations.

One commenter states that the major proposals should require separate rulemaking because of the impact on fleet operation. The commenter states that current regulations provide for takeoff over water and extended overwater flight and are adequate for safe operation and that the use of ATC radar coverage as a means of distinguishing between the two types of operations may introduce undesirable variations in compliance.

One commenter states that the definitions would be beneficial since they recognize both rescue resources and the threat to survival. The commenter states that distance from shore is an arbitrary criterion and a matter of custom but bears little on survival needs.

One commenter in favor of the proposed regulatory changes states that unspecified small changes are needed to achieve consistent terminology.

Concerning the proposal to amend Part 25, numerous commenters support, without substantial comment, the revisions of the various sections.

One commenter, supporting the proposed revision of § 25.801, states that the revision would orient the regulations to both unplanned as well as planned water contact. The commenter contends that this is preferable since most accidents have been unplanned.

One commenter, opposing revision of § 25.801, states that there is no substantiation for the revison. The commenter states that structural consequences of ditching depend on airplane configuration, attitude, and orientation with water waves and that in a planned ditching the pilot can follow procedures to minimize damage. The commenter points out that in unplanned water contact, airplane configuration, attitude, and orientation are undefined and that the term "unplanned controlled water contact" is open to a multitude of interpretations which will result in confusion. The commenter points out that inadvertent contact with water can occur, for example, as a result of loss of control during climb-out or extensive overrun following an attempted rejected takeoff and that these conditions cannot be designed for structurally and would be potentially nonsurvivable accidents.

One commenter states that the requirements in current § 25.801 envisage an emergency landing on water and that the proposed changes go beyond the "unplanned controlled water contact" when taken in context with the list of 42 accidents submitted by the petition. The commenter states that an airplane cannot withstand impacts at speeds higher than normal touchdown and with the gear either up or down. The commenter states that accident history shows any successful water landing must be preplanned and precisely controlled. The commenter states that it would be impossible to prepare an airplane for "unplanned controlled water contacts" and that such a requirement is not supportable from the record.

Several commenters in favor of the proposed revision of § 25.1411 state that the term "mass flotation devices" would be more descriptive than the word "rafts."

One commenter in favor of the proposed revision of § 25.1411 states that the provisions pertaining to life preservers meet the needs of water survival and are in agreement with the Society of Automotive Engineers Aeronautical Recommended Practice on water survival equipment. The commenter states that some life preservers on a specific wide-body aircraft are mounted above the seat pan in the seat backs and that another transport, currently being designed, may have life preservers stowed in the bottoms of the overhead passenger service units. The commenter states that such locations are preferable for emergency access and likely would reduce pilferage.

One commenter favors the proposed revision of § 25.1411 regarding the stowage and donning of life preservers, stating that this is important because the size and amount of passenger carry-on baggage has doubled in the past 5 years, and this baggage, which is forced under seats, restricts passenger access to the life preservers and causes passengers to waste precious time in retrieving the life preservers.

One commenter opposes the proposed revision of § 25.1411, stating that there is no documentation in the petition to substantiate the need to don a life preserver in 15 seconds, which appears to be an arbitrary time. The commenter states that the petitioner, in proposing to locate life preservers above seat bottoms, presents no data to substantiate that the traditional location under the seat bottom does not meet the purpose of the proposed new location. The commenter states that this location requirement would be unduly restrictive because it dictates a location in the back of the seat in front of the passenger, in the back of the passenger's own seat, or in the area above the seat where automatically deployed oxygen masks are stowed. The commenter states that study and testing of alternatives should be performed before the traditional service-tested location beneath seats is prohibited as proposed.

One commenter opposes the proposed revision of § 25.1411 regarding stowage of life preservers, stating that it would require the relocation of every lifevest now installed. The commenter states that the traditional underseat location was selected to make the life preserver readily available, removable, and within easy reach, as is required. The commenter states that the underseat location protects the life preserver from damage and pilferage. The commenter points out that at one time vests were stowed in seat backs and, besides being pilfered, were frequently punctured by sharp objects and rendered unusable. The commenter advises that there is a new life preserver being purchased by many air carriers which can be donned in less than 15 seconds and that FAA should consider revising the life preserver TSO in this regard.

One commenter opposes the proposed revision of § 25.1415 regarding secondary flotation equipment to permit each occupant to keep the trunk of the body out of water. The commenter states that no such equipment now exists which would meet the proposed requirements of being within easy reach of each seated occupant and being readily removable from the airplane.

Concerning the proposal to amend Part 121, numerous commenters support, without substantial comment, the revisions of the various sections. Several commenters indicate that comments on related proposed revisions of Part 25 apply in principle to the proposed Part 121 revisions.

Several commenters favor the proposed revision of § 121.339, provided it requires that equipment for extended overwater operations be demonstrated as being suitable for both planned and unplanned water landings.

Several commenters favor the proposed revision of § 121.339 regarding required equipment for operation over water at 53 degree F, except that they favor specifying a higher water temperature to allow a margin of safety. One commenter recommends 60 degrees F as the limit. Several recommend that flotation equipment be required on all overwater flights, regardless of water temperature, explaining that as water temperature increases, the risk of hypothermia decreases, but the risk of shark attack increases. One commenter briefly cited the results of three accidents to support the recommendation, and one commenter submitted two technical articles on hypothermia.

One commenter opposes the revision of § 121.339, as proposed in the petition, pointing out that it is difficult to comment without specific realignment of the text.

One commenter states that the proposed requirement for both life preservers (stowed above seat bottoms) and secondary flotation equipment is excessive. The commenter recommends requiring lifevests for all overwater operations and rudimentary raft capability for inflatable evacuation slides.

One commenter favoring the petition submitted a list of recommendations made by a panel of experts following the St. Croix accident, which included, in part: use of slide rafts, automatically deployed supplementary flotation devices, and quick-donning lifejackets. Another commenter cautions that escape slides should be evaluated to determine the feasibility of using them as flotation equipment without major modifications and that slides are critical in size and weight.

One commenter states that in an unplanned controlled water contact, reliance on lifevests and complex individual flotation devices would cause confusion. That commenter also states that it would be better to rely on multipassenger rafts, operated by trained personnel, as the primary flotation means and to use lifevests and seat cushions to ensure safe transport to the raft.

One commenter states that the inflatable one-person flotation platform cited in the petition as an example is impractical. The commenter states that stowage would be extremely difficult and that each passenger would have to retrieve and don a lifevest and retrieve and carry the platform at the same time. The commenter states that this would delay evacuation and cause more problems than it would solve. The commenter states that the Escambia Bay accident indicates evacuation time is minimal in a water landing.

Regarding the pyrotechnic device, one commenter states that, in lieu of a new TSO, the FAA should develop an advisory circular on the various types acceptable for use by air carriers and FAA inspectors. The commenter points out that the primary ocean locator is the locator beacon and that dye markers are used for daytime location and flares for night.

Concerning the proposal to amend Part 139, one commenter favors the revision of § 139.49, stating that this would allow airport operators flexibility in meeting water survival needs with airport equipment or through cooperative arrangements with local operators.

One commenter favors the revision of §§ 139.49 and 139.55 and stresses the importance of waterborne rescue. The commenter points out that wide-body aircraft can carry 400 passengers and that the required 8 flight attendants plus 3 flightcrew cannot handle 400 people in the water. The commenter states that it is likely that some crewmembers will be incapacitated and that the crew and passengers will need water rescue.

One commenter questions the need and justification for proposed § 139.49. The commenter suggests an advisory circular on existing rescue capabilities. The commenter questions whether the few accidents which occurred justify a substantial change in regulations.

One commenter favors the revision of § 139.55, citing a renewed interest at the FAA-operated Washington National Airport in water rescue and stating that this is a noteworthy improvement over the situation described by the petitioner.

One commenter opposes the changes to §§ 139.49 and 139.55, stating that it is not economically feasible to require an airport to provide adequate waterborne capability to serve its largest aircraft. The commenter explains this could entail the provision, operation, and maintenance of up to 20 watercraft for airports served by wide-body aircraft. The commenter states that the facts presented by the petitioner do not support the need and do not justify the huge cost that would be placed on the air transportation industry. The commenter states that the petitioner failed to identify in the supporting data those accidents in which waterborne rescue would have affected survivability. The commenter stated that in 14 of the accidents cited by the petitioner, the accident was not fatal, occurred far from an airport, or was unsurvivable. The commenter states that a survey of 36 airports near water indicated that 86 percent were provided waterborne rescue service, wholly or in part, by government and 17 percent had an inhouse capability.

In commenting on the possible economic impact of the proposal, one commenter submitted a summary of the costs that would be incurred by six U.S. airlines if the proposed regulations were adopted. Briefly, this summary indicates a typical liferaft costs $3,500 and weighs 130 pounds, and that the added fuel cost for 1 pound of added weight is $25 per year per airplane. One airline operating about 32,000 seats would spend $1 million for lifevest retrofit. One airline would spend $9 million for 900 new flotation escape slides and $8 million for individual flotation platforms, if available, and added fuel would cost $5.5 million per year. The commenter estimates first-year cost to the U.S. fleet at about $42 million for equipment and maintenance plus $38 million yearly for added fuel, a total of $80 million for the first year. The commenter states this does not include the cost of waterborne rescue under the proposed Part 139 changes, which could be significant.

The FAA's analysis is as follows:

> The petitioner clearly states the significance and the principal aspects of the unplanned water-contact type of accident. The information submitted in support of the petition and that provided by various commenters emphasize that unplanned water contact, with the associated post-impact water survival environment, should be viewed as the predominant water accident threat as compared to the planned ditching. It indicates that a broad cross-section of the aviation community and general public perceives the potential for this type of accident as a problem which calls for action on the part of the FAA. Considerable airport and accident data are cited by the petitioner. Although several commenters question the value of these data and the relevance to specific aircraft configurations and accident scenarios, the FAA believes these data reinforce well the premise that a clear potential exists for the occurrence of an unplanned water-contact type of accident in the vicinity of certain airports in the United States. The data on hypothermia submitted by the petitioner provides an insight into one of the more critical factors of short-term water survival. Although some commenters suggest different water temperatures as the baseline for criteria addressing hypothermia, no commenter, nor the FAA, disputes the implications of the petitioner's data or the consequences of cold water immersion in survival.
>
> Contrary to the view of one commenter that current regulations do not address unplanned water contact, the regulations contain requirements intended to account for the full range of crash-landing situations, including the crash landing on land, the planned ditching associated with extended overwater flight, and the unplanned crash landing on water. Most of these current regulations are intended to address all three types of accidents collectively, with requirements on seat retention, occupant head protection, emergency exit marking, emergency lighting, exit access, aisle width, emergency equipment, and cabin interior materials. The objective of these regulations is to provide occupants protection against the crash-landing impact sequence, whether it occurs on land or water, and to ensure quick escape after the airplane has come to rest.
>
> In addition to these collective requirements, certain regulations aim specifically at the crash landing on land, with requirements on evacuation slides, emergency exits, fire protection, and evacuation demonstration. Because a survivable accident on land is more probable than on water, these requirements have added importance and, consequently, are frequently upgraded as technology and economic considerations permit.

Of the regulations pertaining to the two types of water contact accidents discussed in the petition, planned ditching and unplanned water contact, those for the planned ditching associated with extended overwater flight are the more extensive. These include requirements on aircraft impact behavior, flotation characteristics, ditching, emergency exits, liferafts, life preservers, extended survival and emergency locator equipment, and demonstration of ditching evacuation capability. As one commenter points out, these ditching regulations were developed before the advent of civil jet transports and have not been revised substantially since then, even though the improved reliability of multiengine jet transports has greatly reduced the likelihood of a planned ditching. The petitioner seeks to retain these regulations essentially intact to provide for the self-sufficiency and endurance necessary for extended survival in open sea. The FAA concurs in this.

The airworthiness regulations the petitioner proposes to revise are those pertaining to the unplanned water-contact accident. These have been in effect about 25 years and apply to the certification of all transport category airplanes. Although these regulations are less extensive than those on the planned ditching, they clearly evisage the special circumstances which could arise if the airplane were to contact a body of water without warning. They require that each airplane, whether or not intended for extended overwater flight, be equipped with a prescribed number of exits located above the flotation water line and with an approved individual flotation device, readily removable from the airplane, located within easy reach of each seated occupant. These regulations, of course, are in addition to those mentioned above on occupant head protection, emergency lighting, and other features designed to protect the occupants against crash landings in general, whether they occur on land or water. The individual flotation devices required by regulations are defined by TSO-C72b and are generally foam flotation seat cushions, although in many cases inflatable life preservers are used.

The FAA is in full accord with the thrust of the petitioner's presentation. The FAR recognize that extended endurance time is critical to survival following a planned ditching far from land and rescue; similarly, it is clear that short-term endurance is critical to survival in cold water following an unplanned crash landing in water close to land and rescue, as might occur during an approach or departure at an airport adjacent to a body of water. The FAA believes a program for improvement of water survival provisions, as advocated by the petitioner, is warranted to establish, as soon as practicable, a basis for identifying feasible and cost-effective requirements pertaining to the unplanned water-contact type of accident and, if appropriate, to bring these requirements into closer balance with the existing requirements regarding planned ditching. The FAA has such a program underway at this time.

In July 1981, the FAA initiated a research, development, and evaluation program of the scope, and for the objectives, described in the petition. One of the first tasks in this program was the assessment of the feasibility of the petitioner's proposals in light of the prerequisites for any such comprehensive upgrading of the civil fleet's water crash survivability. This program, Survivability in Unplanned Crash Landings in Water, is under the direction of the Office of the Associate Administrator for Aviation Standards and involves development programs at the Civil

Aeromedical Institute at Oklahoma City and the FAA Technical Center at Atlantic City. Inquiries regarding this program may be made to Dr. William T. Shepherd, Office of Aviation Medicine, Federal Aviation Administration, 800 Independence Avenue, SW., Washington, D.C. 20591, telephone (202) 426-3434. Details and the time frame of this program are discussed in several of the following paragraphs.

While the FAA concurs with the petitioner on the significance of the unplanned water-contact type of accident and the general objectives of the petition, it is apparent that certain problems confront the establishment of new requirements in the immediate future. There is not sufficient information in the petition and comments to permit the development and identification of effective options. There is a substantial technical area which must be explored and issues to be resolved before reasonable judgment can be exercised as to how to handle this general matter of water survival. The wide range of comments and conflicting viewpoints expressed in response to the petition are indicative of this.

As is generally the case in establishing new requirements, the basic issue is one of defining the hazard and the exposure to the hazard, developing countermeasures, and defining the circumstances which would call for these countermeasures. The hazard in this case is the unplanned water-contact accident scenario. The exposure is the potential for occurrence. Although the information in the petition and comments addresses this problem and appears to offer some specific solutions, it does not equip the FAA to analyze the numerous possible water contact scenarios, derive the baseline scenario, and proceed with development of equipment and design criteria to counter that scenario. At this time, there are too many different accident situations, types of emergency equipment, and design configurations which have not been evaluated, to reach a valid conclusion as to the proper way to handle the problem. The FAA program aims to resolve these issues. We believe it should be completed as expeditiously as possible to establish a sound technical basis for identifying options. The program is concentrating on the unplanned water-contact type of accident and is taking into consideration the crash-impact sequence, the evacuation process, immersion hypothermia, and any other factors found significant in determining survival. It will entail an assessment of airworthiness design and aircraft emergency equipment vis-a-vis the crash-landing scenario and post-crash survival environment. The program will consider all of the proposals and supporting information submitted by the petitioner.

There are several technical areas in which there is a particular need for information. One of these is in the determination of the hazard exposure and the definition of the circumstances, or airport locales, which warrant consideration of the possibility of an unplanned water-contact accident. The petitioner has proposed new definitions in FAR Part 1 as the means of specifying applicability of the proposed equipment requirements for both "extended overwater operation" and "restricted overwater operation" based, in part, on the location of the flight route relative to ATC radar coverage and on the location of the airport relative to a significant body of water. While several commenters support these proposals, others cite problems which might arise and object to the lack of definition of the term "significant" as used in the petition. The FAA believes a criterion more definitive than that proposed by the petitioner is necessary. One of the key parts of the FAA program is the development of a rational reference criterion which can be used to identify those airport locales for which consideration of the possibility of an unplanned water-contact accident is reasonably practical and those for which consideration is not practical. This is to provide a basis for an efficient and cost-beneficial application of whatever findings or conclusions may be developed in the program. Until this aspect of the problem has been explored and some definitive rationale is available for determining applicability, we do not believe criteria should be established, as proposed in the petition. As one commenter points out, the proposed new definition of "extended overwater operation" would require a number of carriers to upgrade airplanes and carry a full complement of ditching equipment over existing routes. The information and data submitted by the petitioner in this regard is limited, and we find that it does not support such a general upgrading, especially in view of the favorable service experience on ditchings.

Another key area in which information and data are needed is in the development of the baseline accident scenario. The scenario must account for the condition of the survivable space within the cabin from the time the airplane initially contacts the water to the time it comes to rest and the evacuation process is underway. This is necessary to provide the baseline against which various cabin and equipment configurations can be evaluated and their effectiveness and efficiency determined. In regard to a baseline scenario, the petitioner proposes to revise § 25.801(b) and (c) to require that unplanned controlled water contact and unplanned water landing be accounted for in the airplane design, in addition to the emergency landing on water, as currently required for ditching certification. The petitioner does not propose parameters on other means of identifying the specific design impact conditions envisaged in the proposal, such as aircraft speed, attitude, or descent rate. Commenters point out that this lack of definition of scenario could result in various interpretations and confusion in design and that some unplanned controlled water-contact accidents essentially are nonsurvivable.

The FAA program recognizes the importance of a valid and practicable baseline scenario and the complex aspects of establishing and adequately defining the scenario for design purposes. An unplanned crash landing in water might result from various events, such as runway overrun or controlled descent into water. Contact could be made at many combinations of aircraft speed, attitude, weight, fuel loading, and center of gravity, all of which could greatly affect the impact behavior of the aircraft. While the research and development program cannot account for all of the details of the numerous possible sequences of structural behavior in crash landings, there should be some general indication as to what to expect in unplanned water contacts for various types of aircraft and various impact conditions. For instance, if an airplane contacts the water at a given speed, weight, attitude, etc., can that airplane be expected to remain relatively intact, or is massive breakup probable? Will the airplane come to rest upright or inverted? What is the expected flotation time and attitude?

These scenario factors are critical since the efficacy of the required emergency systems and equipment is dependent on the scenario the systems and equipment are intended to counter. For example, if the airplane is expected to undergo an impact sequence which would leave the cabin intact with emergency exits above water and all passengers and crew in sound condition and ambulatory, the proper survival equipment might consist of a few well-placed high-capacity liferafts or flotation platforms which would be deployed by trained crewmembers and able-bodied assistants. If, on the other hand, the airplane is expected to undergo major breakup which would leave some of the passengers and crewmembers incapacitated, the survival equipment configuration might entail a number of readily accessible individual flotation devices dispersed throughout the cabin which would be usable by untrained passengers without the assistance of crewmembers.

The program being carried out by the FAA will include an investigation of the behavior of typical transport airplanes in unplanned water-contact type accidents and the resulting general condition of the cabin, structural damage, flotation time and attitude, availability of exits, and any other factors found relevant to survival. This will provide necessary insight into what to expect in water crash landings of various types of airplanes so that emergency equipment and procedures can be configured accordingly. Much of the work required for this scenario study has been completed under a research program concerned with crash impact scenarios in general and the structural behavior of airplanes involved in accidents. The results of this research program were published recently in three FAA/NASA reports: No. DOT-FAA-CT-82-69, Transport Aircraft Crash Dynamics, dated March 1982; No. DOT-FAA-CT-82-70, Transport Aircraft Accident Dynamics, dated March 1982; and No. DOT-FAA-CT-82-68, Commercial Jet Transport Crashworthiness, dated April, 1982—all of which are available from the National Technical Information Service, Springfield, Virginia 22161.

Considerable technical information concerning performance capabilities of various types of water-survival equipment and cabin design features is still needed. This information is necessary to identify those equipment items and design features which effectively and efficiently counter the design accident scenario and increase survivability. The petitioner favors use of specific types of survival equipment, much of which is the type currently used in service, and proposes revisions of §§ 25.1411, 25.1415, 121.339, and 121.340 to establish new requirements pertaining to liferafts, life preservers, individual flotation devices, and secondary flotation equipment. Secondary flotation equipment is a relatively new concept in survival gear, not mandated or otherwise referenced in current regulations. Essentially, it is a simple and lightweight flotation device which can keep the survivors out of the water but is not intended or equipped for extended survival in open sea as is the liferaft.

The FAA is particularly interested in new ideas and concepts in water survival equipment and in ways of making existing equipment more effective. We do not believe selection of equipment and design features should necessarily be limited to those currently available since some new concept might be found the most effective. The one-person flotation platform cited by the petitioner is an example of the type of new equipment which should be considered. Although commenters contend this particular device is impractical and not available on the general market, it might be found to have sufficient merit to warrant further design refinement and commercial production. Any such new equipment item volunteered by a manufacturer, individual, or other party early enough in the program to allow its consideration, or otherwise obtained by the FAA, will be tested and evaluated. The FAA program is looking into many aspects of survival equipment and design features including quick-donning life preservers, life preserver stowage and access, emergency evacuation slides/rafts, flotation seat cushions, advanced lightweight portable liferafts, and secondary flotation equipment. This will entail thorough evaluations by survival pool tests and, if necessary, open-sea tests to determine the capabilities and performance levels which can be expected.

The FAA issued a notice regarding water-survival equipment in the November 16, 1981, Federal Register (46 FR 56292). This notice announced publication and invited public comment on the proposed comprehensive upgradings of three TSO's on inflatable equipment: TSO-C13d, Life Preservers; TSO-C69a, Emergency Evacuation Slides, Ramps, and Slide/Raft Combinations; and TSO-C70a, Liferafts (reversible and nonreversible). These proposed upgradings are based on research, development, and testing and on the experience in recent aircraft type certification programs. Proposed TSO-C13d would establish a new requirement that a life preserver be demonstrated capable of being donned within 15 seconds by an unassisted seated adult, who has received only the customary preflight briefing. This is consistent with the proposal made by the petitioner.

The equipment testing and evaluation portion of the FAA program has a special bearing on the petitioner's proposal that inflatable evacuation slides serve as rudimentary flotation platforms for unplanned water-contact accidents and that the TSO be revised to require this. Obviously, this concept has merit although its feasibility has not been established for slides in general. If a slide could be inflated, released from the airplane, and boarded by survivors, it would be invaluable in a water-survival situation. Proposed TSO-C69a would foster this concept to some extent. This TSO would establish a new criteria package for the certification of slide/raft combination devices and contain provisions in evacuation slide criteria for optional design features which would permit slides to be usable as rudimentary flotation platforms. Not all slides, however, may be suitable as flotation platforms. Some slides have flotation and water-stability characteristics which have not been evaluated and demonstrated to be appropriate for the purposes of survival equipment. The FAA program is to investigate this matter of slides as flotation equipment, including open-water testing of typical slides, and identify those characteristics and design features which are necessary to ensure that a slide can serve adequately as a flotation platform. This basic work is necessary to place the FAA in a position to develop guidelines and criteria regarding the design of slides for use as water-survival equipment.

As a result of a reported service difficulty, in February 1981 the FAA initiated a program to investigate the buoyancy of flotation seat cushions used in airline service. This program is germane to the petitioner's contention that flotation cushions lose buoyancy after a short time in water. Cushions which have been in long service are being obtained from various air carriers and subjected to cyclical submersion testing in a manner simulating the wave action of an actual survival situation. The objective of this program is to determine if there is some deficiency in current flotation criteria for cushions and, if so, the appropriate means to correct it.

Several of the petitioner's proposals would revise sections of Part 139 to require that each airport which is adjacent to a significant body of water maintain an extensive water-rescue capability. Apropos of the petitioner's proposals, the National Transportation Safety Board (NTSB) recently recommended to the FAA that it "Amend 14 CFR 139.55 to require adequate water rescue capabilities at airports having approach and depature flight-paths over water which are compatible with the range of weather conditions which can be expected. "(Recommendation A-82-89.)

The FAA is reviewing all of Part 139 to update its provisions and ensure that, in compliance with Executive Order 12291, the benefits to society of each requirement outweigh the potential costs to society and to maximize the net benefits to society of the airport certification and operating rules as a whole. The FAA recognizes that there are emergency situations in which ground-based water rescue could be effective, and the FAA sees the positive benefits of planning and preparedness by local governments and jurisdictions for all types of emergencies and accidents, regardless of whether on water or on land. In reviewing Part 139, the FAA will consider the information provided in the petition; however, to adopt the petitioner's proposed revisions while all of Part 139 is under review would be premature.

The NTSB has also recommended to the FAA that it "Survey all certificated airports having approach and departure flightpaths over water and evaluate the adequcy of their water rescue plans, facilities, and equipment according to the guidance contained in Advisory Circular 150/5210-13 and make recommendations for improvement as necessary to appropriate airport authorities." (Recommendation A-82-88.) In respone to this recommendation, the FAA is surveying over 200 airports to inventory their water-rescue capabilities. This information will be used, not only in formulating recommendations to these airports, but also in determining what revisions of Part 139 would be appropriate.

The petitioner specifically proposes that the FAA revise § 139.55(b)(2)(iii) to require that water vehicles be added to the list of surface vehicles and aircraft designated for medical transportation. The FAA, however, interprets "surface vehicles" to include vehicles that travel on water as well as those that travel on land and, while a clarification of this and other provisions may be proposed during the review of Part 139, it is unnecessary at this time.

The petitioner has recommended several actions to complement and facilitate its package of regulatory proposals, among which is the development of a TSO on pyrotechnic devices. The FAA issued Advisory Circular C 91-58, Use of Pyrotechnic Visual Distress Signaling Devices in Aviation, dated May 27, 1982, which describes the approval basis and appropriate uses of various types of devices for both day and night rescue. This satisfies the objective of the petitioner's recommendation, and development of a TSO is not necessary.

The other actions recommended by the petitioner are revision of passenger information cards on individual flotation devices, and publication of advisory material regarding survival zones and coastal water temperatures.

There is merit in these recommendations and they will be taken into consideration along with the results of the FAA program.

In summary, the petitioner has identified a safety matter which, as indicated by the comments, many parties in the aviation community and general public see as a problem calling for corrective action. Although the petitioner proposes a number of specific actions and regulatory changes. there is no supporting information indicating that these proposals are the apropriate means for countering the problem from practical and cost-beneficial standpoints. The petitioner and commenters make clear the possible consequences of cold-water immersion on the survival of occupants following an unplanned water-contact type of accident. The FAA recognizes this critical aspect of water survival and has a comprehensive program underway which is similar to that advocated by the petitioner for the improvement of water survival provisions.

Considerable progress has been made in the FAA program to date, and we expect this program to continue without major problem to its completion which is estimated to be in late 1983. The analysis of water impact accident scenarios and the development of the airport reference criterion on threat exposure are nearing completion. We expect the preliminary reports on these two subprograms to be completed by December 1982. The three proposed TSO's on water survival equipment which were published in the Federal Register drew supportive response from a wide section of the aviation community. More than 60 individual responses containing valuable information and constructive suggestions were submitted. These responses are currently being evaluated. Issuance of the finalized TSO's is expected in late 1982.

In the subprogram regarding the buoyancy of individual flotation devices, more than 70 flotation seat cushions from inservice transport airplanes have been subjected to cyclical submersion testing. We plan to continue this testing as additional cushions become available from service and to complete this subprogram well ahead of the completion of the overall program in late 1983.

The major subprogram in terms of cost and significance is the performance testing and evaluation of various emergency equipment items and design features and the evacuation slides intended for flotation use. This work is taking a critical look at the capabilities and feasibility of equipment and seeking practical and cost-effective solutions to the problem of water survivability. The outcome of this subprogram will depend in large part on the availability for FAA testing of a wide range of state-of-the-art emergency equipment, particularly those new models and experimental prototypes which might offer new and innovative approaches to water survivability. Except in a very few circumstances, the FAA does not have the resources or the responsibility for product development. As a result, the new ideas and equipment being sought in this program must come from the private sector. The FAA takes this opportunity to invite the petitioner and any other party, especially those parties the petitioner deems well-qualified, to cooperate and assist in obtaining items of emergency equipment for testing and evaluation under the FAA program. This, in effect, is an open invitation for any party, finding it to its competitive advantage, to volunteer or loan equipment items to the FAA and to call attention to the merits of their equipment through an objective and impartial evaluation.

In view of the progress made to date, we believe the FAA program should be completed to develop requirements pertaining to survival before specific actions, such as those proposed, are taken. Any action taken before completion of this program would be premature and could waste time and money in addressing an issue which has not been evaluated thoroughly. We also believe that the petitioner's proposals should be taken into consideration to enhance the scope and effectiveness of the FAA program.

In consideration of the foregoing, I find that rulemaking, as proposed, is not appropriate at this time. Therefore, in accordance with rulemaking procedures of Part 11 of the Federal Aviation Regulations, the petition of the Air Line Pilots Association to amend Parts 1, 25, 121, and 139 of the Federal Aviation Regulations is hereby denied.

Issued in Washington, D.C., on November 30, 1982.

J. Lynn Helms
Administrator

Mr. Levitas. Thank you very much, Mr. Ashwood, for your testimony. We, all of us, appreciate the words that you spoke about our efforts. I can only tell you that I think it is quite clear, we are very much committed now to seeing something done. We had hoped for a long time that FAA would discharge its responsibility. They have made a dismal record in this area. It cost human lives. What you have just reported as their attitude in terms of firefighting equipment at airports only exacerbates the problem and indicates to me an absurd approach on the part of an agency that ought to be leading the charge in this area.

I want to say one other thing. That over the last few years I have had occasion to work closely with ALPA and people in ALPA on this area. And while obviously there is a very large amount of self-interest involved because that is your work environment, I want to say that I am very proud of what ALPA has done in taking the lead in this area.

Even though you realize the economic interest and profitability of the companies for which you work, ALPA has always put safety number one on its list of concerns in everything that I have ever seen them do.

Mr. Ashwood. Thank you for recognizing that, sir.

Mr. Levitas. A few questions. You know that the pilot on the DC-9 Air Canada had some difficulty with the goggles and emergency breathing equipment that he had.

Mr. Ashwood. Yes, sir.

Mr. Levitas. Are you satisfied that the protective breathing equipment provided to the flight deck today is adequate?

Mr. Ashwood. As a general basic rule, sir, because they do vary from aircraft to aircraft. With my understanding of the type of equipment that was installed on that aircraft, the answer would have to be no. I would defer to Mr. O'Brien who has more expertise in this area.

Mr. Levitas. Mr. O'Brien.

Mr. O'BRIEN. We heard testimony earlier of some work done by CAMI looking into smoke goggles, smoke masks, which came out of the Pan Am accident at Boston-Logan. And since that time we have requested CAMI to do some additional work based on some newer aircraft and some additional equipment has been put on these new aircraft. Sadly to say, what CAMI has found out, that most of this equipment, 90 percent of it, is deficient in the area. It doesn't provide the protection that is intended.

Mr. LEVITAS. Another incredible disclosure. We have learned that the same type equipment, which has been certified by FAA for the 767 and 757, the newest and most modern generation of aircraft, has been tested and found to have leaks in it.

Mr. O'BRIEN. Yes.

Mr. LEVITAS. Which is like having an umbrella that doesn't keep the rain off.

Mr. O'BRIEN. That is correct. That was part of the CAMI tests I was referring to.

Mr. LEVITAS. Has ALPA taken any action with regard to this report and this situation?

Mr. ASHWOOD. That is a pretty broad ranging question, Mr. Chairman. Yes, we have is the short answer. Exactly what we have done, of course, is spread over an entire, our entire range of activities, all the way from legislative activities down to our regulatory and safety areas. We probably have somewhere on the order of 20 technical committees working on some of these problems and the sub-problems that emanate from them. We have been ceaselessly working on them for as long as I have been involved which is some 15 years.

Mr. LEVITAS. Are pilots trained to deal with in-flight fires?

Mr. ASHWOOD. Yes, sir; we are. It is part of our initial training and part of our recurrent training.

Mr. LEVITAS. We heard from the flight attendants yesterday that they get training, but it is book training. They are lectured. They are given little slogans to repeat. But they are never given the opportunity actually to take a fire extinguisher in their hand and to put out a fire and to see what it is like or how to do it.

How is it in the case of pilots training?

Mr. ASHWOOD. I can only speak for myself, sir, from the airline I come from. I have had some hands-on experience with fire extinguishers. I believe it is probably repeated about once a year during recurrent training, where we are shown how to operate a hand extinguisher and actually extinguish a small fire which is ignited in a waste bin or something.

In addition, of course, our training as pilots would be largely involved in the technical procedures that one uses for, first of all, to remove smoke, which is a primary concern because if you don't remove the smoke you can't fight the fire. And as most fires we have experienced to date emanate from electrical sources, also protect ourselves against total loss of electrics. So I would say that the training the pilots receive in this particular regard is intensive, is repetitive in our recurrent training, but of course is focused upon maintaining the aircraft in a flying condition. That is a long answer.

What I am trying to say is they are trying to allow us to fly the airplane. They are not trying to make us firemen. So the firefighting aspect is a secondary consideration.

Mr. LEVITAS. Yesterday, Mr. Grubbs described his experience and observation. In the course of it, he mentioned the fact that the door to the cockpit was open during that descent. From your experience what would be the significance of that?

Mr. ASHWOOD. It is hard to say, sir. Customarily we keep the doors closed in the event of fire or smoke in the cabin, for obvious reasons, because there is a tendency on most aircraft, and I should say I am not a DC-9 pilot, for smoke to come forward if it has room to come forward. I can't sit here in the safety of this hearing room, though, sir, and second guess the pilot. I am not sure and I don't know why he would have occasion to open the door. But I would have to assume he had a good reason to do it.

Mr. LEVITAS. Apparently that entire area filled up with this dense black smoke. And you heard Mr. Werjefelt's testimony about this concept that they are working on which he said might be available within 60 days to permit the pilot to maintain sight both through the windshield and of critical instruments. Did you get a chance to look at those sketches?

Mr. ASHWOOD. No, sir; I did hear the description of how the device would work. I would very much like to see it. In fact, I signaled Mr. O'Brien and asked him if he knew anything about it at the time. I will say this about it. If his claims for its efficacy are accurate I would like to have it tomorrow. But of course I can't judge that because I heard about it for the first time this afternoon.

Mr. LEVITAS. Well, you might, you or Mr. O'Brien, take a look at those sketches. Obviously neither you nor I know at this point whether it will actually work.

Mr. ASHWOOD. It sounds like a good idea.

Mr. LEVITAS. If it does prove out to work in that fashion, it seems to me to be a very simple and inexpensive solution to something that, just given the experience of this Air Canada situation, might have made all the difference in the world really.

Mr. ASHWOOD. I agree, sir.

Mr. LEVITAS. I want to tell you that I agree completely with you about the life raft situation. I find it strange that they deliberately don't require enough life raft capacity for the capacity of the aircraft. I am sure there is some logic someplace in some bureaucrat's mind as to how that could make sense. But it escapes me. And also the fact which I also agree with that there ought to be life preservers on every aircraft because if you're flying over Lake Pontchartrain or the Potomac River, if you go into the water, it is enough water to drown in. You don't have to be in the Atlantic or Pacific Ocean.

What type of training do the flight crews receive in the use of these life rafts and vests?

Mr. ASHWOOD. You get initial training, sir. In fact, if you are flying extended flights over water you get training in the deployment, of inflation and use of the raft itself in some body of water such as a swimming pool or some benign outside facility.

Subsequently during recurrent training one sees a movie which I have seen probably 40-odd times, twice backwards just to relieve the boredom, which again repeats all the necessary information so that you don't forget it over a 12-month period. I would say that the training as far as the use of the life rafts is concerned is probably adequate.

But that assumes, of course, that you have one onboard if you are obliged to ditch. It is not very much good to you if you don't.

Mr. Levitas. In the flight emergency training are there situations in which the cabin attendants and the cockpit crew train together so that there will be some sort of coordination or team effort in handling a flight emergency and evacuation?

Mr. Ashwood. No; I would say each group is trained separately from each other. Of course we are trained to coordinate, but the actual coordination is never conducted. We are just told to conduct the coordination.

Mr. Levitas. Do you think it would be a good idea for there to be some coordinated training for emergency procedures where the necessity is to work together and make sure signals are the same?

Mr. Ashwood. I think it would be a wonderful idea. From the point of view that any training we have would do nothing but enhance the situation, I am not sure how we would work out the logistics of it. But I am sure that problem could be overcome.

Mr. Levitas. I have just seen some flight attendant training on the use of life rafts. Rather than having it deployed and used in a swimming pool, as you pointed out, it was done in a very large meeting room on the floor, not in the water. And I am not sure that that gives people a real good idea of what it is like to handle a life raft in water that has different properties of response to what you are doing.

Again, it is just not a real life situation.

Mr. Ashwood. I agree, sir. As a matter of fact, one of the occasions when I was trained I did it in Botany Bay outside Sidney, Australia, where we were surrounded by sharks. It made it very real indeed, as a matter of fact.

In addition, I don't mean that just to be flippant, sir. Inasmuch as the situation was so real I remember everything about that particular training period, because of the realism that existed there. It really came home. That had to be, I hesitate to say how many years ago it was, but it was many years ago. And I can remember it in great detail—the training, I mean.

Mr. Levitas. Thank you very much. I have some further questions but I will defer at this point. I will say that your suggestion that there are some things that ought to be done right now, in fact, should have been done a long time ago but certainly right now, that can be done without waiting another year or 6 months has not slipped past me. I intend to discuss the matter with the older members of the subcommittee and see how we might begin to address that. That is my own opinion, but I think that FAA has done a despicably sorry job in providing for the safety of the traveling public in some of the very clearcut areas that we have heard testimony about for years. And that something could have been done. It hasn't been done.

My patience is totally exhausted in this regard, and I want to see some action taken.

Mr. ASHWOOD. Could I comment on your comments?

Mr. LEVITAS. Absolutely.

Mr. ASHWOOD. When you refer to the FAA, and I understand, of course, because we are both involved in the same field you are referring to some portion of the FAA.

Mr. LEVITAS. Yes.

Mr. ASHWOOD. Our Association would like to acknowledge, as did previous organizations, factions within the FAA, such as CAMI, and the old NAFAC, and technical people at that level are probably unsurpassed anywhere in the world. The staff they have there is awesome in their dedication to their job. They tend to get lumped in when one says "the FAA."

Mr. LEVITAS. Your point is well taken. I have on many occasions praised many operations within FAA and some of their personnel. It is a large bureaucracy and I don't mean to paint everybody with the same brush. I appreciate your making that point. But in the area of management safety responsibilities, there is to me something incredible at work or not at work within FAA. It has been there for years. There have been GAO reports about it. There have been congressional hearings on the subject.

In some respects I don't even hold a fault, I do hold responsible higher management. They don't even know what is going on. It never gets up to them.

Mr. ASHWOOD. That is correct.

Mr. LEVITAS. In this area we are talking about human life, as you point out in your statement. And an inadequate emphasis has been given to dealing with this problem effectively. There has been too much wasted effort and time and wasted lives.

Mr. Molinari.

Mr. MOLINARI. Thank you, Mr. Chairman.

Mr. Ashwood, you were here before when the first witness testified I assume.

Mr. ASHWOOD. Yes, sir.

Mr. MOLINARI. You heard the chairman and myself make some reference to stories we have heard, that there may be in fact a move made in the very near future to disassemble CAMI, or at least to have massive reassignments of the personnel there to other areas. What do you think the impact of that would be?

Mr. ASHWOOD. If I may, sir, I will answer in this way. If CAMI didn't exist, we would have a requirement to invent it. It would be a tragedy. The proportions of which I just can't even grasp because this is the first I had heard of it. It is inconceivable someone would contemplate such a thing.

Mr. MOLINARI. If it would prove true, would you take back the statement you have on page 1 of your testimony that you want to applaud Mr. Helms for getting the process moving?

Mr. ASHWOOD. I would certainly be forced to reevaluate it.

Mr. MOLINARI. I am pleased to hear that. I think we have somebody in the room from FAA. I would hope that they would convey that message back to Mr. Helms. It seems that everybody that has testified here from whatever level has the same impression of CAMI and the wonderful job they are doing. Boy, I tell you it would be a tremendous step backward if they moved in the direction which the chairman and I have heard today.

I will be glad to defer to Dr. Rowland who has to leave.

Mr. ROWLAND. Thank you very much. I appreciate that. There was one matter I was particularly interested in that was brought to our attention yesterday by Mr. Grubbs. He said that someone on the flight deck when the circuit breaker tripped, reset it. It again tripped, and he reset it again. I wonder what the procedure is about tripped circuit breakers?

Mr. ASHWOOD. I must point out, sir, I am not a DC-9 pilot but customarily on the aircraft that I am qualified on, which are the Boeing 727 and 707, one resets a tripped circuit breaker once. Of course I was not in the cockpit of that airplane and I don't know what circumstances were prevailing. I have to assume they were either troubleshooting or were desperately trying to recover some service that they had lost and they needed rather badly.

Mr. ROWLAND. But it is not customary to reset tripped circuit breakers, then?

Mr. ASHWOOD. Yes, sir, you do reset once but normally you don't reset more than once on the aircraft I have flown. And I have to make an assumption to answer you, that most aircraft would be the same, that you only reset a circuit breaker once. If it trips again, you leave it alone.

Mr. ROWLAND. One other question if I may. This is not clear in my mind. Were you here during the demonstration of the mask?

Mr. ASHWOOD. I saw the video tape, sir. Is that what you are referring to?

Mr. ROWLAND. Would this mask have functioned to decrease the amount of smoke that the people were breathing on the Air Canada flight in your opinion, or do you know enough about that to make that statement?

Mr. ASHWOOD. I don't know enough about it to render an opinion. I would guess, yes.

Mr. ROWLAND. Thank you very much. Thank you very much for yielding.

Mr. MOLINARI. You seemed a little shy and reticent before about admitting to the time when you received your training, Mr. Ashwood. Let me not ask you when that was, but would you mind telling us how long you have been a pilot?

Mr. ASHWOOD. I am 46 years old, so I have been a pilot for 28 years, military and civil.

Mr. MOLINARI. Mr. O'Brien, how about yourself, how long have you been a pilot?

Mr. O'BRIEN. Twelve years.

Mr. MOLINARI. Have either of you gentlemen been involved in a personal experience as a pilot when there has been a fire in any portion of the plane?

Mr. ASHWOOD. Only as a combat pilot on a single seat aircraft, which wouldn't be germane to these hearings.

Mr. MOLINARI. You are talking about commercial planes?

Mr. O'BRIEN. Not on commercial.

Mr. MOLINARI. Mr. O'Brien, did you have an opportunity to operate a fire extinguisher such as Mr. Ashwood did during training period?

Mr. O'BRIEN. Yes, sir. It was years ago when I was with Pan Am, and I have been with ALPA on staff position for 10 years. So it was several years ago. But part of your training as a pilot, you did actually have hands on experience with a fire extinguisher. But as Captain Ashwood has pointed out that was not your primary training with regard to fire onboard airplanes. Your primary concern was with aircraft systems, electrical, communications, hydraulic, and maintaining that aircraft in a flightworthy condition.

Mr. MOLINARI. With whom would the obligation to cope with the fire then rest on the plane?

Mr. ASHWOOD. Perhaps I can answer that. The simple answer is the captain is responsible for everything onboard. Obviously that doesn't answer your question. It depends upon the location of the fire. The flight attendants are a highly trained professional group of people who are trained to cope with cabin fires as best they are allowed to with the equipment they have available.

So if I were flying as captain on a flight and I had just a two-man crew as the Air Canada people did, I would, and based upon my experience, have the most confidence in the flight attendants and their training and their capabilities. I wouldn't share the same confidence in the equipment that they had, though.

Mr. MOLINARI. It is my understanding that when the problem broke out on Air Canada, the copilot got involved. He either asked or ran to the back of the plane with two flight attendants.

Mr. ASHWOOD. That is customary, sir. If you have any sort of unusual occurrence, be it an unruly passenger or something of this nature, to have a cockpit crew member to go back there and check on the situation and report back to the captain, because he may want to make a decision about an immediate landing or whatever. That is a normal procedure.

Mr. MOLINARI. I have a little problem in my own mind with trying to equate the testimony we have heard today. The prior witness testified to something I found kind of surprising. He quoted I think it was the Aviation Institute magazine or some periodical. There is one fire every 2 weeks in a lavatory on a plane. Did you hear that portion of his testimony?

Mr. ASHWOOD. I did hear it, sir, and I must admit my eyes opened up a little bit, too. These are statistics that I am not familiar with.

Mr. MOLINARI. Mr. O'Brien, you are the safety expert for the pilots?

Mr. ASHWOOD. Of course he would be dealing also with light airplanes, also, general aviation, I assume were included in those statistics.

Mr. O'BRIEN. We don't have any information that would indicate to us that the occurrence is that frequent. Again, I am not aware of the source of his information.

Mr. MOLINARI. It would seem to me that indeed if the information was anywhere near accurate, if it was once a month or whatever, that there would be a greater burden or should be a greater burden on those in the cockpit to help or assist in case there is a fire onboard. I am kind of surprised that there isn't a greater emphasis placed upon you people in helping to deal with emergencies such as that.

I would welcome a response.

Mr. **Ashwood**. I agree there is not a lot of emphasis in terms of our training and recurrent training in this regard. The reason for this I can only guess at. I can only guess that the airlines figure that a cabin fire is probably best dealt with by the cabin personnel; that is, the flight attendants. Fires in lavatories that are caused by cigarettes in the trash bin and so forth appear to be the most common source of these fires. I suppose they feel they can be best dealt with by a flight attendant and not a pilot.

Mr. **Molinari**. We are going to have to excuse ourselves momentarily to go vote. I would just like to ask one last question. As pilots, how do you feel about the possibility of a ban on smoking on a plane, or some flights?

Mr. **Ashwood**. Well, as a person that quit smoking just 19 months ago——

Mr. **Molinari**. You are very much opposed to it I am sure.

Mr. **Ashwood**. It wouldn't bother me at all because I quit 19 months ago. I really don't think that is the answer, sir You will have more people smoking in lavatories if you do that.

Mr. **Molinari**. Fine.

Mr. Chairman, I think this might be an appropriate time to break.

Mr. **Levitas**. Fine. I think we will take a very brief recess, go vote and then come back and finish with questions. The subcommittee will stand in recess for 10 minutes.

[Recess.]

Mr. **Levitas**. The subcommittee will come to order.

I think that is all the votes that we expect today on the floor. Now we will be able to proceed directly through to the conclusion of the testimony of all the witnesses today.

Mr. Molinari.

Mr. **Molinari**. Before we broke, there was conversation about firefighting techniques, and the fact that the testimony was that you would leave that up to the cabin crew. We have had other testimony with respect to incidents that might occur on the plane, testimony about people who might have imbibed too much, or what not, and we have heard some of the attendants indicate that there has been a tendency on the part of some of the pilots to not want to get involved.

Is there any policy with respect to that area? Would you mind commenting?

Mr. **Ashwood**. No, sir. There is no policy that I am aware of, but it is basically a matter of a judgment call by the captain as you are probably aware, more and more of the aircraft we fly these days require two cockpit crew members, and by sending one of them back there you have reduced your force by 50 percent.

If you are in circumstances, bad weather, a busy traffic area, I can think of numerous flight conditions under which I would never reduce my cockpit force by 50 percent, unless it was an extreme urgent circumstance. So most of the time we are obliged to rely upon the actions of the cabin crew. It has been my experience that that is usually a reasonable thing to do.

Mr. **Molinari**. Has ALPA ever taken a position on this question?

Mr. **Ashwood**. The question of——

Mr. MOLINARI. The question of disruptive passengers and the manner of dealing with it.

Mr. ASHWOOD. Yes. We have dealt with this, of course, in the field of security, which happens to be a field of expertise that I am involved in, and again it is very hard to really outline recommending courses of action, unless you are there. Each one is so different, each circumstance is so different, because what mode of flight are you in? Are you in an approach area, a holding pattern, are you across the North Atlantic, close to an airport?

All these questions and the answers to the questions are factors. One has to rely upon the leadership and the training and the experience of the captain, the pilot in command. We have found over the life of the industry in fact that that is usually the best course of action; to leave it to the discretion of the pilot in command and let him disperse his forces.

Mr. MOLINARI. I am not questioning the performance of the pilots. I hold them in very high regard. I am just wondering, however, what specific recommendations. You did mention there were recommendations made by the pilots. Do you recall any specifically that dealt with the passengers and passengers who might be guilty of disruptive behavior?

Mr. ASHWOOD. Yes. If I could describe the circumstance, let's just say you have a passenger back there, my first reaction would be to send a crew member back to assess the situation and assess are the cabin crew capable of dealing with that particular situation. If he reported back to me the answer is yes, well, I would take whatever action I deemed appropriate at that time. But I would not require my crew to go back and assist them, if they could handle it on their own.

If the assessment was no, they needed assistance, of course, obviously that is a greater priority than the one I am coping with right now. I would send a member of my crew back there.

Mr. MOLINARI. An attendant who might have difficulty in the usual situation; they are mostly female attendants on a plane. Suppose you had somebody who was out of order, would the attendant come to the front of the plane to ask for assistance? Does that happen?

Mr. ASHWOOD. It does happen. I don't know what proportion of the time they cope with it themselves. I know that a lot of the time they cope with it, and usually very well. Psychological studies would indicate that a recalcitrant passenger and even hijackers in fact are much more prone to have a better behavior pattern toward a female than they would a male.

While we do have a number of female pilots, they are very few in number, so the flight attendant, the female flight attendant in the particular instance you described is probably the best person to handle such a circumstance as that.

Mr. MOLINARI. I think we are about to get an apology by the chairman on a prediction he made before.

Mr. LEVITAS. Absolutely. Every time I make an announcement that we are not going to have any more votes, we always have more votes. We will just have to wait and see. I think we can wait a few minutes and see what happens on the second bells.

Mr. **Molinari**. If you would, would you turn to page 3 of your prepared testimony.

Mr. **Ashwood**. Yes, sir.

Mr. **Molinari**. At the bottom of page 1, of the four areas that you recommended that we look at, and quickly, is the term you use, that "No commercial aircraft should be dispatched if any of its emergency lights and doors are not functioning properly. There should be no discretion left to anyone on this subject."

I was not aware that a plane would be permitted to take off if its doors were not functioning properly. Is that the case?

Mr. **Ashwood**. Yes, sir. I would like to defer to Mr. O'Brien to give you a more complete answer.

Mr. **Molinari**. If you will, Mr. O'Brien.

Mr. **O'Brien**. On certain aircraft, particularly the wide-bodied aircraft, you can dispatch aircraft with one or more emergency exits inoperative. There are certain circumstances that have to be complied with, but it is our position and the position of our Rescue and Fire Committee that you cannot forecast what kind of circumstances you may eventually run into in event of an accident. We feel that all emergency exits and all emergency equipment should be available.

Mr. **Molinari**. I take it, then, emergency doors, emergency exits would not be on the minimum equipment list, I think is the term that they make reference to?

Mr. **O'Brien**. That is correct.

Mr. **Molinari**. It is not on it.

Mr. **Ashwood**. It should not be on it. That is what we are claiming. It should not from this point forward be included in the minimum equipment list.

Mr. **Molinari**. Let me understand this. Maybe I misunderstand the term "minimum equipment list." Would you mind defining it for me.

Mr. **O'Brien**. Not at all, sir. Minimum equipment list indicates that you may dispatch an aircraft or it may be flown with something broken on it, if certain circumstances are met. In other words, you could go without one generator because you have two more on a four-engine aircraft, this type of thing. So it is permissive in the sense that you may depart with malfunctioning or nonfunctioning equipment. We don't want an emergency exit, lights, doors, or any of that stuff, to ever be on that list that you can go without.

Mr. **Molinari**. Item 2, you talked about a subject that we have heard a great deal of, particularly since the Air Canada incident, the exit lights being installed at the lower section of a plane. Do you have any particular system in mind that you are referring to here in your testimony?

Mr. **Ashwood**. Yes, sir. You could in fact take the type of lighting that is installed right now as a matter of fact, and you could install it at seat level, arm level. You could install it at foot level, at doors, for instance, because it would be much more visible, obviously, than it would be at the height where the smoke is.

There are such lights, for instance, such as these high-intensity lights which you see that flash. They are particularly brilliant. I am not an expert in this field, but it would indicate to me in my inexpertise that such lights would probably be highly visible in a smoke situation, if it illuminated a whole door in a flashing sequence.

Mr. MOLINARI. You are talking about strobe lights, for example?

Mr. ASHWOOD. A type of light of that nature. I have no doubt there is a mass of data on how far you can see in whatever density of smoke, but if you just took the existing lights and put them at a floor level or a seat-arm level it would be a tremendous improvement over what we have now.

Mr. MOLINARI. I must confess that when we were at CAMI, I thought I came up with an ingenious idea, and that was to have strobe lights installed over the exit doors, and I thought that that might be very useful in an emergency such as Air Canada. Then they took me about 10 feet down the stretch we were at and there, indeed, was a strobe light, but CAMI had rejected it on a basis that in an accident similar to Air Canada, strobe light or not, you wouldn't be able to see it.

Mr. ASHWOOD. It wouldn't do it?

Mr. MOLINARI. There does seem to be some movement toward the installation of exit lights at lower level. In fact, if I am not mistaken, I think it is one of the things that FAA is looking at or even recommending.

Mr. ASHWOOD. I believe Mr. Helms, in fact, came out with something fairly recently on that.

Mr. MOLINARI. I think that was after the Air Canada incident, as a matter of fact.

Mr. ASHWOOD. I believe it was, yes.

Mr. MOLINARI. Mr. Chairman, I will defer back to you. I have a couple of other questions but I would like to put them together here.

Mr. LEVITAS. Thank you, Mr. Molinari.

Mr. Ashwood, I understand you had an opportunity to examine the sketches of the concept that we looked at earlier?

Mr. ASHWOOD. Yes.

Mr. LEVITAS. The sketches were shown by Mr. Werjefelt for providing visibility in the cockpit. I wonder if you have any reaction, based on what you saw in those sketches?

Mr. ASHWOOD. Yes, sir, I do. It seems like a heck of a good idea. I would like to see it investigated fully. We intend to have our engineering and safety staff look at it. But just at a very brief glance, it seems like the first time I have seen something that appears to address a problem that hasn't been solved to this date.

Mr. LEVITAS. Could you describe for us—I don't think we have gotten into this yet, and I think it ought to be made a matter of record—the way in which airline pilots deal with the carriers, in approaching matters of safety. Is there a formal structure? Does it differ from carrier to carrier? I am leaving aside the FAA role now. I am talking about within the industry itself.

Mr. ASHWOOD. Yes, sir; there is a formalized structure. It exists on those carriers that enjoy the benefits of having their pilots unionized, that is not an entirely self-serving statement, because when you have an organization such as ALPA, we do have large research facilities. In other words, we have the wherewithal to provide research and suggestions on safety.

As a result, we create a formalized structure. We have a large safety structure, for example, in ALPA. Which in turn, of course, has local branches within the various airlines, the 46 or 47 airlines that we represent. They in turn recognize—I was going to say usually—are always recognized in fact by the carriers as being a proper representation of pilot safety groups.

Now as to the measure of their success, that depends, of course, on a number of factors, their persuasiveness, the willingness of the management to listen to their requirements and so forth. It is like anything else in life, sir; it really depends upon what the needs are at a particular time and how persuasive one can be in putting those needs to those that can provide them. On a larger scale, of course, we do this nationally, which is why we are sitting here now. This is a national project as opposed to a local project, so it is a multithrust thing that we do.

The airlines do listen to us. I like to think that they listen to us because we are respectable, and we should be listened to, and we know what we are talking about. Sometimes they listen to us because they fear us. That is a normal mode of doing business, too, I understand, but for whatever reason, they do listen to us.

Mr. LEVITAS. I thank you very much. I have maybe one more question but I will reserve it for later. Mr. Molinari.

Mr. MOLINARI. I would like to clarify something on the pilot's response in case of a cabin fire. Is there any general policy adopted, for example, by ALPA, with respect to getting a plane down when there is a cabin fire?

Mr. ASHWOOD. I don't believe there is an ALPA policy. We try to avoid wherever possible to establish operational policies or procedures. Forgive me if I sound repetitive, sir; but the circumstances under which these things occur are usually so different from a previous one, or one before that, that it is almost impossible.

When I declined earlier to second guess the Air Canada captain, it wasn't because I was trying to protect a brother pilot. I don't know what was happening there because I wasn't there, so it is difficult to produce something that is going to cover all eventualities. Whatever is best under the circumstances, basically, would be our policy.

Mr. MOLINARI. That would be a judgment call, again, of the pilot?

Mr. ASHWOOD. Yes.

Mr. MOLINARI. Under the circumstances. I recall the one I guess it was the Saudi plane where apparently the pilot did not recognize that he himself as well as the passengers were in immediate peril.

Mr. ASHWOOD. That seems apparent, yes.

Mr. MOLINARI. Did any recommendations come about as a result of an incident like that?

Mr. ASHWOOD. I am aware of some.

Mr. MOLINARI. Mr. O'Brien, is there any device that you know of that could be installed in the aircraft where you could have a reading, for example, on toxicity that is present in a plane so the pilot knows what he is coping with?

Mr. ASHWOOD. I can answer. There is not, sir. For instance——

Mr. MOLINARI. For example, smoke is coming in. We heard a witness testify yesterday, something I think we were all surprised about, that the door was open. There was some other testimony indicating it was just a panel at the bottom of the door but the survivor said he was there, he saw inside, he heard the communications between the ground and the plane, and the door was open. Isn't there a better system to adopt so that we can ensure that at least the pilot will be able to get that plane down or have the best chance of getting it down?

Mr. Ashwood. I know of no system that couldn't be improved, and there is no doubt the system that you are referring to, whatever they were using, could be improved also; but knowing the toxicity level of the smoke in your cabin is probably of academic interest by the time that you are aware it is there. I don't mean that sarcastically, sir; inasmuch as it is already there and you are probably suffering from the effects of it, because a lot of the poisonous stuff is invisible in nature.

What I would be more interested in having is something that would guarantee to remove it rather than what level it was at, or removing the source of the fire or the source of the smoke. I just cannot believe that technology, state-of-the-art technology, cannot provide us an answer to that, that couldn't fill, for instance, that cabin with some agent, some agent which would sustain life and at the same time destroy the ability for smoke to be produced. This is where we need to have our research done.

Mr. Molinari. I agree with your point. I was just wondering. We had some testimony on polyimide, which is the substance that NASA had developed, and we found out and issued a press statement back in December 1980, and here we are in 1983, people were not aware that the substance was available. There might be some problems with it. I understand the question of durability was raised, but I also understand that that problem has now been overcome.

Mr. Ashwood. Yes, I believe there is a different material.

Mr. Molinari. And the difference in the Air Canada crash with the two substances, polyurethane, which I am told is usually used, and this other substance, the polyimide—I may be pronouncing it wrong. But it is incredible.

Mr. Ashwood. It is. It is something like 1 percent as opposed to 100 percent.

Mr. Molinari. That is correct. In the case of smoke, zero.

Well, I thank you very much for your testimony and your patience. I appreciate it very much.

Mr. Levitas. My last question related to one of the points you make in your testimony about there should be a mandatory no-go on aircraft where emergency exits, and so forth, are not functioning. What surprised me is that this is not already required. Does an airline or a flight crew have the right to take off with an aircraft in which emergency exits are not working?

Mr. Ashwood. Do they have a right to, sir? Yes, they do. The airline in fact could, I suppose, insist that you take a flight if it conformed to the standards required by FAA, minimum equipment list, approved minimum equipment list. Of course, the final decision rests with the captain. Now, that depends upon what airline he flies for, what pressures he would be subject to. You made some reference to it earlier, some comments that you made about the association's concern over the economic viability of the carriers, and of course it is a real concern. No-go/go items such as this on some carriers could make a great deal of difference to their economics. These things all come into play.

I would like to think that any airline captain, regardless of whether he was an ALPA pilot or a non-ALPA pilot would make the most conservative decision, but I would like to think that but I happen to know that doesn't always occur, of course.

Mr. LEVITAS. I think the point is well taken, as I have observed previously in connection with other matters on the need for regulatory action, that in areas of this sort, where there is a real or perceived economic advantage for one carrier to do something that it's competitor is not doing or vice versa, you want to eliminate the competitiveness over safety factors, and therefore you don't want to even give the opportunity for one carrier, as compared to another, to say we will operate this flight because it will cost us so much if we don't, and the same would be true with respect to materials and equipment, and so on.

Mr. ASHWOOD. They never use that as an advertising point. That is the interesting thing. In the whole development of the industry, comparative advertising is very common, how their pilots are handsomer, how their flight attendants are prettier, but they have never used that we are safer, because everyone recognizes, of course, that that could change overnight. But that is our big problem. In fact, my president sat in this very chair two weeks ago testifying as to his concerns about the diminution of safety because of the economic conditions of the airlines.

Mr. LEVITAS. I remember in some hearings we had several years ago I asked one or two of the witnesses the same question, I think industry witnesses, who were talking about what a good job they were doing in terms of safety. I said, have you ever considered advertising this fact, that you are doing such a good job? And it was almost as if I had uttered some bad four-letter words at that point. They didn't like the idea at all. And I understand, I suppose, why that is the case.

Are you familiar with the total flood concept as proposed by a former TWA flight engineer?

Mr. ASHWOOD. Essentially, yes, I am, sir.

Mr. LEVITAS. Do you have any thoughts or comments on it?

Mr. ASHWOOD. I defer to Mr. O'Brien, who has more expertise.

Mr. LEVITAS. Mr. O'Brien.

Mr. O'BRIEN. I think the concept has considerable merit. When we first became aware of it, one of the potential drawbacks was total weight of the system. I think that there is some new information available now that has provided a system with much less weight than originally the concept involved, so obviously it should be investigated further, especially for cargo compartments, smaller areas, lavatories, and that kind of thing, it may be ideal. Now, when you get to the larger main cabin area, we would have to start to look at it a little bit further.

Mr. LEVITAS. I thank you very much, Mr. O'Brien and Mr. Ashwood, for your presence here, and for ALPA's testimony. The president of your organization, Captain Duffy, I believe is his name——

Mr. ASHWOOD. Yes, sir.

Mr. LEVITAS [continuing]. Is a constituent of mine.

Mr. ASHWOOD. I know that, sir.

Mr. LEVITAS. And even though he is a Republican——

Mr. ASHWOOD. I forgive him that.

Mr. LEVITAS. Most airline pilots are, I gather. Well, just the economic strata that you find yourselves in.

Mr. MOLINARI. Would the gentleman yield?

Mr. LEVITAS. I will be happy to yield.

Mr. MOLINARI. I was under the impression it was an intellectual status that made the difference.

Mr. ASHWOOD. For the record, sir, I would like to state that I am a Democrat.

Mr. LEVITAS. That was obvious from the excellent testimony that you gave today. I am very proud of what Captain Duffy is doing.

Mr. ASHWOOD. We are, too.

Mr. LEVITAS. As well as the Air Line Pilots Association. And I want to express the gratitude of this subcommittee for your contribution to our hearings. Thank you.

Mr. ASHWOOD. Thank you very much.

Mr. LEVITAS. The next two witnesses, if they would come up as a panel together, are Monica Kaufmann, secretary-treasurer, Independent Federation of Flight Attendants, and Bonnie Harris McKenna, Central Safety Chairperson, Union of Flight Attendants.

As their titles indicate, they are flight attendants, and represent organizations that are very much involved in the problem of safety. As we heard yesterday from another flight attendants organization, the critical role that is played by flight attendants is one which we are very conscious of and believe that the FAA and the carriers and the traveling public should be as well.

We look forward to your participation and your contribution. You may proceed as you so desire. Thank you for being here.

TESTIMONY OF MONICA KAUFMANN, SECRETARY/TREASURER, INDEPENDENT FEDERATION OF FLIGHT ATTENDANTS, AND BONNIE HARRIS McKENNA, CENTRAL SAFETY CHAIRPERSON, UNION OF FLIGHT ATTENDANTS

Ms. KAUFMANN. Mr. Chairman and members of the subcommittee, we thank you for inviting us to testify today. My name is Monica Kaufmann. I am the secretary-treasurer and national safety chairperson of the Independent Federation of Flight Attendants. We are the labor organization certified as the exclusive and authorized collective bargaining flight representative of all flight attendants employed by Trans World Air Lines.

While preparing our statement for this subcommittee, we carefully examined and analyzed the safety environment of the aircraft passenger cabins we all work in. This examination and analysis leads us to two inescapable conclusions: First, passenger cabins in today's commercial aircraft lack even the basic safety features one could reasonably expect given existing technology; and second, the Federal Aviation Administration has been derelict in the application of its mandate prescribed by title 49 USCA section 1302 which gives the assignment and maintenance of safety as the highest priority in air commerce.

Congress has specifically stated that it is the intent that the agency shall and must take the lead in safety responsiblity. When a passenger engages an airline, that passenger is statutorily entitled to expect the highest possible level of safety. This expectation cannot be fulfilled when the FAA defends obsolescence in the name of the minimum standard mandate.

IFFA acknowledges Administrator Helms' recent announcement that the agency will soon issue NPRM's on fire and crash safety improvements. Mr. Helms says these improvements "will constitute the most dramatic single step forward in airplane safety in a quarter of a century." In fact, it is the only dramatic step in cabin safety in the last 25 years. Unfortunately, he also maintains that it will take another 5 years to put fire-resistant seat cushions and cabin aisle lighting requirements into effect.

One need not be an expert in aviation safety to find the technological deficiencies in today's aircraft. The potential for fire is evident in aircraft galleys and lavatories. Yet, fire/smoke detectors, a common safety appliance in contemporary society, are nowhere to be found in aircraft interiors.

Knee-level aisle lighting attached to the aisle side of passenger seats, and found in movie theaters throughout the country, is not standard safety lighting in an environment with enormous potential for fire and heavy smoke. Passenger life vests differ from one airline to the next. These are but a few of the obvious areas that warrant necessary improvement.

What isn't obvious to our passengers or even those Members of Congress and their staffs who maintain a level of expertise in aviation safety, is the cavalier approach the FAA assumes when certifying an aircraft for emergency evacuations. I personally participated in the evacuation certification of the Lockheed 1011 aircraft in 1973. In a certification exercise, a full aircraft is to be evacuated, through half the available exits, in 90 seconds or less. The exercise is video and audio taped, both inside and outside the aircraft.

The crew is not told which exits will open, a fact that can only be determined once the exercise begins. Those parameters seem reasonable in theory. The reality is substantially less than reasonable.

In the Lockheed certification, the participating crew members were admonished time and again by both Lockheed officials and FAA personnel that each day the airplane remained without a certificate both Lockheed and the airlines which ordered the 1011's were losing "big money."

Upon boarding the aircraft in the Lockheed hangar at Palmdale, CA, the flight attendants were met with some interesting surprises. Kitchen chairs, in lieu of passenger seats, were taped to the floor. Styrofoam objects and baby dolls, representing baggage and children were thrown in the aisle as obstructions of egress. Lockheed employees and their families, with an obvious vested interest in the certification of the aircraft, were the "passengers." However, the most interesting surprise, and the one which obviously gave an advantage to the crew, was the placement of the cameras and microphones for the taping. A flight attendant didn't need to waste precious seconds looking out the door portal to determine if there was red foil indicating a fire.

If there was a microphone attached to a jumpseat adjacent to an exit and a camera, mounted on the overhead, which pointed to that exit, it was obvious that door was a "go" door. The crew knew immediately which doors should be opened and where to direct the "passengers." We didn't need to check our doors and turn people around in midstream to use a different exit. And the FAA and Lockheed personnel knew we knew.

The exercise was a failure on the first day because it took 4 hours to get the hangar dark enough for the filming. By then the "passengers" were almost comatose from sitting in a closed, unair-conditioned plane for such a long time.

So by the second day of the exercise, the desperation of the Lockheed and FAA people was almost palpable, not to mention the crew's whose only desire, after 4 days in Palmdale, was to get home. The 1011 was evacuated on the second day, in 82.7 seconds, a real record.

Notwithstanding the skewing of the results by virtue of the totally unrealistic emergency conditions, it continues to amaze me that the airplane was certified by crewmembers with such a divergence of training. TWA, Eastern, PSA, Delta, and Air Canada participated in the certification exercise. Yet each airline had its own FAA approved method of the proper way to evacuate passengers.

However, it appeared to the participating crews that the FAA's priority in the certification was not to provide the flying public with the safest possible aircraft from which passengers could be evacuated in 90 seconds or less under hazardous emergency conditions, but to certify an aircraft, through a dismally inadequate process, in order that the aircraft manufacturer and airlines wouldn't any longer bear the burden of an economic albatross.

Notwithstanding the absurdity of the certification evacuations, both passengers and cabin crews today are confronted, on an ongoing daily basis, with some very real threats to their lives.

In light of the recent rash of lavatory fires, we think it necessary to attempt to shed light on some of the problems we, as flight attendants, experience in preventing such potential disasters.

As you know, departure briefing announcements made to passengers clearly state that smoking is prohibited in any location other than a designated smoking seat. Additionally, lavatory doors are placarded with "no smoking" signs.

Nonetheless, given the passenger service requirements on today's aircraft, it is impossible for flight attendants to monitor the aisles and lavatories for periods sometimes exceeding 1 hour. For example, TWA's Lockheed 1011 is configured with five lavatories in the rear of the aircraft to facilitate the needs of 248 coach and ambassador-class passengers—the ambassador-class being the business-class passengers—40 percent of whom are smokers.

The flight attendants working the coach and Ambassador cabins push aisle serving carts through the cabin starting at the front and working to the back of the aircraft. During the cocktail service, the lavatories cannot be monitored for approximately 1 hour. During the meal service, the lavatories cannot be monitored for almost 1½ hours.

Additionally, while the flight attendants are serving from the carts in the coach cabin, which occupies the back half of the aircraft, passengers can and do stand in the aisles and service centers while smoking.

The potential for smoking-related and/or electrical fires under these circumstances is enormous. Everything on an airplane will burn, smolder, emit toxic fumes when burning or smoldering or do all of the above. From the paper products in the lavoratories to the passenger seats, the plastic bulkhead material to flight attendant uniforms—from the carpets to the class divider curtains—literally everything on board is a conflagration waiting to happen.

And instead of mandating only ABC-type fire extinguishers that will extinguish any kind of fire, whether electrical, grease, or paper, the FAA continues to permit the use of water fire extinguishers. If a flight attendant, in a moment of confusion upon discovery of a lavatory fire, grabbed a water extinguisher that is located adjacent to the aft lavatories, he/she had better hope the fire is a paper fire, not an electrical fire. We, as flight attendants, should not be put in the position of determining the cause of a fire. In such a situation, as the Air Canada disaster clearly illustrates, time is of the essence.

Flight attendants, no matter how well trained, can only work with the tools the government and the industry provides us. Passing out wet napkins inside a burning aircraft cabin speaks volumes about a flight attendant's ingenuity and heroism under incredible pressure. It also speaks volumes about the FAA's egregious disregard of its congressional mandate, providing the flying public with the safest possible means of air travel.

We, as flight attendants, don't want to be heroes or heroines. We only want and, indeed, have the right to expect that the FAA finally devote its energies to providing an aircraft interior that is the safest possible environment for our passengers and ourselves.

There are products and materials on today's market that, if incorporated into aircraft interiors, would give meaning to the words "safest possible"—smoke/fire detectors, automatic fire extinguishers, fire-retardant fabrics and materials that don't emit debilitating or lethal toxic gases. Some of these products are currently used by NASA in the space shuttle program. NASA manages to send a handful of astronauts into space each year. The 430-plus U.S. air carriers currently regulated by the FAA carry millions of passengers every year. Surely the flying public has the right to expect a contemporary reality equivalent to that enjoyed by those few Americans employed by NASA.

It is the position of the 6,500 flight attendants on Trans World Airlines, that it's long past time that the FAA concentrate as much attention on cabin safety as it has on the integrity of the aircraft powerplants and airframe structure. It is an incredible irony when every mechanical and hydraulic system on an airplane has two backup systems in the event of failure, yet once that airplane lands, half the passengers inside are dead as the result of a fire in the cabin.

With the introduction of the Boeing 747 in 1969, the focus of the industry has been toward configuring the new wide-bodied aircraft with smaller, thinner, lighter weight seats to increase fuel efficiency, seating capacity, and, therefore, profit capability. The FAA's focus within cabin interiors has been merely to certify these seats for airworthiness. There has been no major thrust on the part of the FAA to make the necessary and available improvements in cabin safety. Unfortunately, costs of retrofitting old aircraft will be high. Nevertheless, safety is a bargain at any price, a concept the industry and FAA have yet to accept.

Thank you for your attention, gentlemen. I will be happy to answer any questions.

Mr. LEVITAS. Thank you very much.

[The prepared statement of Ms. Kaufmann follows:]

WRITTEN TESTIMONY OF MONICA KAUFMANN, ON BEHALF OF THE INDEPENDENT FEDERATION OF FLIGHT ATTENDANTS, BEFORE THE OVERSIGHT AND INVESTIGATIONS SUBCOMMITTEE OF THE PUBLIC WORKS AND TRANSPORTATION COMMITTEE

I, Monica Kaufmann, am Secretary/Treasurer and National Safety Chairperson of the Independent Federation of Flight Attendants (IFFA), the labor organization certified as the exclusive and authorized collective bargaining representative of all flight attendants employed by Trans World Airlines (TWA).

While preparing our statement for this Subcommittee, we carefully examined and analyzed the safety environment of the aircraft passenger cabins we work in. This examination and analysis leads us to two inescapable conclusions:

1. Passenger cabins in today's commercial aircraft lack even the basic safety features one could resonably expect given existing technology; and

2. The Federal Aviation Administration has been derelict in the application of its mandate perscribed by Title 49 USCA Section 1302 which states:

(a). In the exercise and performance of its powers and duties under this Chapter, the Board shall consider the following, among other things, as being in the public interest and in accordance with the public convenience and necessity: (1) The assignment and maintenance of safety as the highest priority in air commerce; and (2) The prevention of any deterioration in establishing safety procedures, recognizing the clear intent, encouragement and dedication of the Congress to the futherance of the highest degree of safety in air transportation and air commerce, and the maintenance of the safety vigilance that has evolved within air transportation and air commerce and has come to be expected by the traveling and shipping public.

The mandate of this section is clear. Subsection (1), above, clearly states that it is not the carriers themselves that are to take the lead in safety but the Agency. Congress has specifically stated that it is its intent that the Agency shall and must take the lead in safety responsibility. When a passenger engages an airline, that passenger is statutorily entitled to expect the highest possible level of safety. This expectation cannot be fulfilled when the FAA defends obsolescence in the name of the minimum standard mandate.

(IFFA acknowledges Administrator Helms' recent announcement that the Agency will soon issue NPRMs on fire and crash safety improvements. Mr. Helms says these improvements "will constitute the most dramatic single step forward in airplane safety in a quarter of a century." In fact, it is the only dramatic step in cabin safety in the last 25 years. Unfortunately, he also maintains that it will take another 3 years to put fire-resistant seat cushions and cabin aisle lighting requirements into effect).

One need not be an expert in aviation safety to find the technological deficiencies in today's aircraft. The potential for fire is evident in aircraft galleys and lavatories. Yet, fire/smoke detectors, a common safety appliance in contemporary society, are nowhere to be found in aircraft interiors. Knee-level aisle lighting attached to the aisle side of passenger seats, and found in movie theaters throughout the country, is not standard safety lighting in an environment with enormous potential for fire and heavy smoke. Passenger life vests differ from one airline to the next. These are but a few of the obvious areas that warrant necessary improvement.

What isn't obvious to our passengers of even those members of Congress and their staffs who maintain a level of expertise in aviation safety, is the cavalier approach the FAA assumes when certifying an aircraft for emergency evacuations. I personally participated in the evacuation certification of the Lockheed 1011 aircraft in 1973. In a certification exercise, a full aircraft is to be evacuated, through half the available exits, in 90 seconds or less. The exercise is video and audio taped, both inside and outside the aircraft. the crew is not told which exits will open, a fact that can only be determined once the exercise begins. Those parameters seem reasonable in theory. The reality is substantially less than reasonable.

In the Lockheed certification, the participating crew members were admonished time and again by both Lockheed officials and FAA personnel that each day the airplane remained without a certificate both Lockheed and the airlines which ordered the 1011s were losing "big money."

Upon boarding the aircraft in the Lockheed hanger in Palmdale, California, the flight attendants were met with some interesting surprises. Kitchen chairs, in lieu of passenger seats, were taped to the floor. Styrofoam objects and baby dolls, reprsenting baggage and children were thrown in the aisle as obstructions of egress. Lockheed employees and their families, with an obvious vested interest in the certification of the aircraft, were the "passengers." However, the most interesting surprise, and the one which obviously gave an advantage to the crew, was the placement of the cameras and microphones for the taping. A flight attendant didn't need to waste precious seconds looking out the door portal to determine if there was read foil indiating a fire. If there was a microphone attached to a jumpseat adjacent to an exit and a camera, mounted on the overhead, which pointed to that exit, it was obvious that door was a "go" door. The crew knew immediately which doors should be opened and where to direct the "passengers." We didn't need to check our doors and turn people around in "mid-stream" to use a different exit. And the FAA and Lockheed personnel knew we knew.

The exercise was a failure on the first day because it took four hours to get the hangar dark enough for the filming. But then the "passengers" were almost comatose from sitting in a closed, unairconditioned plane for such a long time.

So by the second day of the exercise, the desperation of the Lockheed and FAA people was almost palpable, not to mention the crew's whose only desire, after 4 days in Palmdale, was to got home. The LO11 was evacuated on the second day, in 82.7 seconds, a real record.

Notwithstanding the skewing of the results by virtue of the totally unrealistic "emergency conditions", it continues to amaze me that the airplane was certified by crew members with such a divergence of training. TWA, Eastern, PSA, Delta and Air Canada participated in the certification exercise. Yet each airline had its own FAA approved method of the "proper way" to evacuate passengers.

However, it appeared to the participating crews that the FAA's priority in the certification was not to provide the flying public with the safest possible aircraft from which passengers could be evacuated in 90 seconds or less under hazardous emergency conditions, but to certify an aircraft, through a dismally inadequate process, in order that the aircraft manufacturer and airlines wouldn't any longer bear the burden of an economic albatross.

Notwithstanding the absurdity of the certification evacuations, both passengers and cabin crews today are confronted, on an ongoing daily basis, with some very real threats to their lives.

In light of the recent rash of lavatory fires, we think it necessary to attempt to shed light on some of the problems we, as flight attendants, experience in preventing such potential disasters.

As you know, departure briefing announcements made to passengerts clearly state that smoking is prohibited in any location other than a designated smoking seat. Additionally, lavatory doors are placarded with "no smoking" signs.

Nonetheless, given the passenger service requirements on today's aircraft, it is impossible for flight attendants to monitor the aisles and lavatories for periods sometimes exceeding one hour. For example, TWA's Lockheed 1011 is configured with five lavatories in the rear of the aircraft to facilitate the needs of 248 coach and Ambassador passengers, 40% of whom are smokers. The flight attendants working the coach and Ambassador cabins push aisle serving carts through the cabin starting at the front and working to the back of the aircraft. During the cocktail service, the lavatories cannot be monitored for approximately one hour. During the meal service, the lavatories cannot be monitored for almost one and a half hours. Additionally, while the flight attendants are serving from the carts in the coach cabins, which occupy the back half of the aircraft, passengers can and do stand in the aisles and service centers while smoking.

The potential for smoking-related and/or electrical fires under these circumstances is enormous. Everything on an airplane will burn, smolder, emit toxic fumes when burning or smoldering or do all of the above. From the paper products in the lavatories to the passenger seats, the plastic bulkhead material to flight attendant uniforms—from the carpets to the class divider curtains—literally everything on board is a conflagration waiting to happen.

And instead of mandating only ABC type fire extinguishers that will extinguish any kind of fire, whether electrical, grease or paper, the FAA continues to permit the use of water fire extinguishers. If a flight attendant, in a moment of confusion upon discovery of a lavatory fire, grabbed a water extinguisher that is located adjacent to the aft lavatories, he/she had better hope the fire is a paper fire, not an electrical fire. We, as flight attendants, should not be put in the position of determining the cause of a fire. In such a situation, as the Air Canada disaster clearly illustrates, time is of the essence.

Flight attendants, no matter how well trained, can only work with the tools the government and the industry provide us. Passing out wet napkins inside a burning aircraft cabin speaks volumes about a flight attendant's ingenuity and heroism under incredible pressure. It also speaks volumes about the FAA's egregious disregard of it's Congressional mandate—providing the flying public with the safetst possible means of air travel. We, as flight attendants, don't want to be heroes or heroines. We only want, and indeed, have the right to expect that the FAA finally devote its energies to providing an aircraft interior that is the safest possible environment for our passengers and ourselves.

There are products and materials on today's market that, if incorporated into aircraft interiors, would given meaning to the words, "safest possible"—smoke/fire detectors, automatic fire extinguishers, fire-retardant fabrics and materials that don't emit debilitating or lethal toxic gases. Some of these products are currently used by NASA in the space shuttle program. NASA manages to send a handful of astronauts into space each year. The 430 plus U.S. air carriers currently regulated by the FAA carry millions of passengers every year. Surely the flying public has the right to expect a contemporary reality equivalent to that enjoyed by those few Americans employed by NASA.

It is the position of the 6,500 flight attendants on Trans World Airlines, that it's long past time that the FAA concentrate as much attention on cabin safety as it has on the integrity of the aircraft power plants and airframe structure. It is an incredible irony when every mechanical and hydraulic system on an airplane has two back-up systems in the event of failure, yet once that airplane lands, half the passengers inside are dead as the result of a fire in the cabin.

With the introduction of the Boeing 747 in 1969, the focus of the industry has been towards configuring the new wide-bodied aircraft with smaller, thinner, lighter weight seats to increase fuel efficiency, seating capacity, and, therefore, profit capability. The FAA's focus within cabin interiors has been merely to certify these seats for airworthiness. There has been no major thrust on the part of the FAA to make the necessary and available improvements in cabin safety. Unfortunately, costs of retrofitting old aircraft will be high. Nevertheless, safety is a bargain at any price—a concept the industry and FAA have yet to accept.

Mr. LEVITAS. Ms. McKenna, do you have a statement you care to make?

Ms. MCKENNA. No, I do not. But I will submit a statement for the record later.

Mr. LEVITAS. All right, thank you. Without objection, it will be entered in the record at this point.

[Statement referred to follows:]

STATEMENT OF BONNIE HARRIS MCKENNA, CENTRAL SAFETY CHAIRPERSON, UNION OF FLIGHT ATTENDANTS, TO THE SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT, COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION

Mr. Chairman and Members of the Committee: On behalf of the Union of Flight Attendants may I express my sincere appreciation to you for allowing me to testify before your Committee here today regarding the subject of aircraft cabin safety.

When invited to appear before your Committee I was instructed to select a topic of my choosing relating to the broad issues of cabin safety. It is sad to note that the issues of cabin safety remain the same year after year and are essentially dormant footnotes until a newsworthy event occurs to focus public attention on passenger safety, especially when injury and lifetaking airplane catastrophies make headlines.

In this regard concerns for cabin safety are two-fold. From the views of activities or lack of same by the Federal Aviation Administration (FAA) and its closely allied lobby group, the Air Transport Association, to the reluctance by the airlines industry to adopt small but significant improvements in cabin safety which without question will have and would have had a positive impact in the reduction of casualties in every aircraft accident.

While we tend to direct our thinking toward improved products because they appear to present immediate solutions to on-going problems, we forget to look a bit deeper at what I believe to be the root cause of our inability to create and cause effective improvements in the survivability statistics of aircraft accidents or incidents: the relationship between the FAA and the ATA.

There are numerous instances where the forces of lobbying for management and airline owner economics hold sway over decisions made by the FAA. Many of these instances result in a lack of timely review and approval for improved safety techniques and the installation of equipment that can make the cabin environment safer for the thousands of people who travel American airways daily.

A prime and very recent example of the pressure exerted by the ATA to thwart an objective review, and discussion, by all concerned segments of the airline industry about the increasing of incidents of aircraft hijacking occurred in Miami on July 6, 1983. Owing to the increasing number of hijacking events taking place in Florida—destination Cuba—the FAA, on extremely short notice, called a meeting. All regional FAA Headquarters were notified and asked, through their principal security inspactors (PSI), to notify all labor groups (i.e., Pilots and Flight Attendants) in their area of the meeting and to encourge our representation in Miami. I along with other Flight Attendant union safety representatives were provided a one-day notice along with the invitation to attend the meeting. This short notice precluded many of us from traveling across the country to be present. Due to the extreme importance of the subject to be discussed, representatives from Flight Attendant unions were located and in position to attend the meeting.

Most people when they hear of a hijacking attempt are not aware of the fact it is a Flight Attendant, not Company management, nor the Pilots or ground personnel who look down the barrel of the hijacker's gun or at the currently popular Molotov cocktail. Flight Attendants are the face-to-face conduit of information between the hijacker, the cockpit and the passengers.

I am informed by those few Flight Attendant representatives that were in Miami, that on the day of the meeting members of ATA met with FAA officials in Washington. Due to a reluctance by some air carriers to thoroughly inform and train their inflight personnel (Flight Attendants and Pilots) about hijacking procedures and expecting the Miami meeting to expose some air carriers laissez-faire attitude about hijacking, ATA successfully altered the original course of the FAA meeting. Hijacking is a Federal offense. The Federal government, with their experts and expertise, should be making the decisions and procedural recommendations, not the airline industry, and least of all ATA.

This, in my opinion, ladies and gentlemen, appears to countermand the basic charter of the FAA, which is to provide "services with the highest possible degree of safety in the public interest". When the ATA can effectively collude and re-structure a FAA meeting that speaks to the very people whose lives are on the line and are trained to protect the passengers and aircraft in these violent situations, is not an example of providing services with the highest degree of safety!

I think it is important to note that those of us representing Flight Attendants from the independent unions constitute representation in excess of two-thirds of the Flight Attendants employed in the United States. For this reason we feel our inclusion in meetings involving cabin safety and hijacking a must, not a concession to enhance the decor of the meeting room.

Another example of my point occured in 1981 when the ATA and FAA attempted to re-structure Federal Air Regulation (FAR) 121.391. This regulation provides the formula on which the ratio of Flight Attendants per aircraft seating capacity is determined. The Regulation provides for one Flight Attendant per fifty passenger seats. The FAA and ATA wanted to change the words "seats" to "passengers". Fortunately, Congressman John Burton conducted Sub-Committee hearings on this issue and as a result of the information brought to light, the notice for proposed rule making (NPRM) was defeated. Had the FAA and the ATA succeeded it would have been possible, under certain load conditions, on a 747, to reduce the number of required Flight Attendants to two. A 747 has eleven emergency exits. During testimony, before the Burton Sub-Committee, the FAA representatives cited the ATA for initiating the NPRM and, in turn, the ATA cited the FAA as the initiator!

There are, no doubt, many other instances I could continue to note. The continual granting by the FAA of exemptions to the FARs asked for by the ATA on behalf of the airline industry is a prime example; to enumerate would be an exhausting task. One has only to watch the Federal Register; it speaks for itself.

My second point regards the activities or more importantly the lack of activities by the FAA in providing approval for items that can be installed either on aircraft or on airfields that have tested and qualified beyond question.

Approximately 70% of all take-offs and landings from commercial airports in the United States are over sizeable bodies of water. Furthermore, how many people realize the cushion you sit on, which the placard on the seat back or tray table in front of you indicates to use as a flotation devise, might in the best of situations keep you afloat about three minues; yet life vests and/or adequate flotation devices are not required. Due to economic considerations, for the air carriers, the FAA has exempted the carriers from carrying life vests unless the flight is traveling over 50 nautical miles from shore. We know only too well the waters of the Potomac and the waters of Escambia Bay in Pensacola, Florida, not considered through the FAA exemption to be over-water flights, can drown people just as quickly as any ocean of the world.

Smoke detectors in aircraft lavatories: Smoke detectors for lavatories in commercial aircraft were recommended by the National Transportation Board (NTSB) to the FAA for approval and installation approximately fifteen years ago. The Air Canada fire is a horrible way to be reminded that the airline industry is behind the times when it comes to installing this simple, lightweight, inexpensive piece of equipment. How many more lives must be lost before the FAA issues a regulation requiring the installation of smoke detectors. It is interesting to note only one commercial air carrier, Muse Air, a no smoking airline, has smoke detectors in the lavatories of their aircraft.

Run way distance markers: The Pilots, for years, have asked to have markers placed every thousand feet down the run ways to give them a visual distance reference for take-offs and landings. All military installations have these markers on the run ways—why not the commercial airports as well?

Better fire-retardant materials for aircraft cabin interiors and seats: The airlines argue that the improved materials weigh more and that in turn result in higher fuel consumption. In other words, fire-retardant materials are not "cost effective". I believe this argument to be moot in light of the number, size and weight of baggage (including carry-on baggage) allowed to be carried on U.S. carriers. A weight restriction that is fair and equitable is an easy solution—European air carriers have baggage weight restrictions, so it is a possible solution.

Cabin lighting systems: During an emergency, lighting systems inside the aircraft cabin automatically switch to a bright mode to provide optimal lighting. The lights are wonderful providing there is no fire or smoke. Smoke rises, as we all learned in elementary science, and yet all the lights on all aircraft are on or at the ceiling. Even in daylight conditions, note the Air Canada fire, dense smoke obscures visibility of exits and exit lighting. The FAA has spent countless dollars and numbers of years studying this phenomena, but we still, even in the new generation aircraft, do not see floor level lighting systems.

Better and more uniform emergency training: The training Flight Attendants receive is as diverse in quality as there are number of airlines. The only common denominator is the number of hours spent during initial and recurrent training as per the FARs. Because training is subjected to the approval by the air carriers then current principal operating inspector (POI) training subject material and performance is vastly different from year to year within the same airline company and throughout the industry. Actual hands-on training in the use of emergency equipment found on board the aircraft, by the Flight Attendant who might be called upon in an emergency to use, has been substituted in many cases, by movies or video-taped demonstrations of the equipment. Truly a sad and dangerous note.

Carry-on baggage: A subject on constant battle between the passenger with too much carry-on and the Flight Attendant responsible for the air carrier's compliance with the FARs. Flight Attendants are subjected to an overwhelming amount of verbal and physical abuse because storage space on board the aircraft is inadequate to accommodate all the carry-on and the industry's refusal to: (1) increase the storage space; or (2) support the Flight Attendants.

In the time allotted I have tried to highlight some of my many concerns and those concerns of all Flight Attendants which are major problems and the causes of impediments to properly improve aircraft cabin safety standards and increase survivability. We who are employed as professional Flight Attendants, dedicated to the safety of airline passengers, are continually puzzled over the constant series of bureaucratic battles and delays that thwart progress.

Congressman Levitas and Members of this Committee, we are counting on you to bring order to the chaos that reigns over the FAA.

Mr. LEVITAS. Your testimony about the certification evacuation demonstration is obviously shocking. It is not only an indictment of what can happen, but for the people who permit it to happen, I find it difficult to understand who they think they are kidding.

What do they hope to achieve by not seeing whether or not their aircraft is sufficiently configured and constructed so that in a real life situation it will work? Have you ever discussed this with any of the officials of the FAA or the airframe manufacturers, to ask them why they do it?

Ms. KAUFMANN. No, sir; the only way I could really answer that, without directly answering your question, not having discussed it directly with these people, is to reiterate that we were put under enormous pressure to certify the airplane, the reason being that it was costing Lockheed, TWA, Air Canada, Delta, PSA, Eastern, whomever else was participating, literally hundreds of thousands of dollars every day not to certify that aircraft. It seems when dealing with the FAA and the airlines in safety, the economic factor is not only the major factor, it is the only factor.

Mr. LEVITAS. Let me ask you a question about smoking. The passengers, based on your experience, frequently smoke in lavatories even when flight attendants are present in the vicinity?

Ms. MCKENNA. Yes, I found that to be true, that they will smoke, and if you ask them to come out of the lavatories and not to smoke, explain the reason, a good 50 percent of the time they will just tell you it's tough luck and go back in there, lock the door, and smoke their cigarettes.

Mr. LEVITAS. It has been suggested that there is also illegal smoking that goes on. I don't mean just illegal because it is illegal to smoke, but the substance involved. There are not infrequent examples of pot-smoking in lavatories. Have you heard about that? Do you know anything about that?

Ms. KAUFMANN. It is not only in the lavatories, it is actually in the cabins of the airplane. It seems that individuals who desire to smoke controlled substances don't really care too much where they smoke them. I would have to say—and I think that Bonnie would probably agree with me—the majority of people who are smoking grass in the airplane are doing it in the lavatories.

Mr. LEVITAS. Are there any situations where some flight attendants may never have been trained on newly acquired equipment?

Ms. KAUFMANN. Yes, both aircraft equipment and interior equipment, new oxygen equipment.

Mr. LEVITAS. What concerns me about that is obviously the fact that each aircraft has its own special characteristics. And you may be familiar with how to operate an emergency exit, or where a safety device is located in one aircraft, or even the feel of a door will vary from aircraft to aircraft.

Do you think that a person who hasn't received training on a particular aircraft is capable of performing the necessary safety functions on another aircraft?

Ms. KAUFMANN. I think we should both answer that. I want to answer for TWA because I don't know what Continental's policy is. As a matter of policy TWA does not on any wholesale level place unqualified people on new equipment or equipment that they are not qualified on. However, as a matter of practicality what they will do is make sure that the basic of a minimum staff is on the airplane, for instance, on the Lockheed 1011, the minimum is five flight attendants on the airplane with eight exits.

The company will put five Lockheed qualified personnel on the airplane and put additional staffing, which can go up to 10 or 11 people, on the airplane who are not qualified and who do not know how to operate the doors.

While I say they don't do it, as a matter of policy, it is a matter of getting the airplane off the ground. It is economics. No, these people do not know how to operate the doors. The doors on the Lockheed 1011 are certainly singular. They are peculiar in their operation, different then the Boeing aircraft which is the majority of aircraft TWA operates. They are entirely different.

Mr. **Levitas**. Ms. McKenna.

Ms. **McKenna**. In substance I agree with Monica. My airline does not place unqualified flight attendants on board, although we do have equipment on board that I myself have never operated, that is, our halon fire extinguishers which we were all converted over to. I have never seen a fire put out by a halon fire extinguisher, aircraft type. All I have done in recurrent training is pick it up and look at it.

Mr. **Levitas**. Speaking of halon fire extinguishers, did you happen to hear the testimony yesterday of the firefighters who indicated that halon, the halon extinguishing material when used in a confined place is a toxic material?

Ms. **McKenna**. Yes, I did and I am familiar with the studies he was referring to.

Mr. **Levitas**. Has this question ever been raised by your association with the carriers?

Ms. **McKenna**. Yes, I have had many questions come to me about it. As I said I did research it. I have found that the toxic substances given off are minimal in light of the fact that you are facing, perhaps, a gasoline torched fire in your cabin and it is imperative you put the fire out as quickly as possible.

I am not a flight engineer but I know they can exchange the air in the airplane quite rapidly. So therefore I don't think we are really going to be subjected to having any ill effects with putting a fire out with halon materials.

Mr. **Levitas**. Several years ago we had some hearings about cabin safety. We had a number of examples that came to our attention about the fact that the flight attendants' seats were themselves not very secure. In fact, were less secure than the seats of passengers.

Since flight attendants are essential to a safe evacuation, the need to avoid incapacitating flight attendants is quite important. In fact I remember one of your employers uses one of the aircraft that we saw some bad examples of, such as putting the seats against nonbulkhead walls, just those little separators. And garment racks and things like that.

Now, are you aware of any examples of unsecured or inadequate seating for flight attendants today?

Ms. **Kaufmann**. If we can both answer that again.

Mr. **Levitas**. Yes.

Ms. **Kaufmann**. Yes; many examples. For instance the state-of-the-art aircraft, the Boeing 767, has really an appalling example. In the first-class cabin, one of the first-class cabin attendants' jumpseats is attached to a bulkhead that is not a stationary bulkhead in the sense that it is a part of the fuselage. Not only is it attached to a nonstationary bulkhead, it is within 2 feet of the coat compartment which is also not stationary, where garment bags are hung, where the rods for the garment bags are stressed for 75 pounds, they are really stressed for 9 g as long as they only hold 75 pounds.

We have protested the location of this jumpseat to the company and to the FAA. Their answer is that it is certified and it is not a problem. Furthermore, as long as we don't put more than 75 pounds on the rod the stress will hold. I have indicated to the company that we don't have scales on the airplane where we can weigh the garment bags. As you know, especially going out of Washington with a lot of commuter people with garment bags, we can get over 100 pounds with the first five passengers that board the airplane.

The company, after my request, simply issued a notice in their flight attendant organ, their bulletin to the flight attendants, that from now on when passengers boarded the airplane, while there were not scales on the airplane, to make sure that no more than 75 pounds of garment bags were put on the rod. That is one airplane.

On the 727 we have a jumpseat that is attached to a coat compartment. Once again it is not a stationary bulkhead. We protested that because it is adjacent to the opening of the closet and the garment bags, notwithstanding the strap restraint that is put on, will swing out and kill a flight attendant with any sort of lateral g force.

We did manage to get rid of the jumpseats that were attached to the galley wall. That is about as much success as we have had only because those airplanes are now obsolete. We no longer fly them.

Ms. McKENNA. Speaking for my own company, we, all of our jumpseats are attached to permanent bulkheads. We have no problem. But I am aware and have heard tales that the other airlines still have maintained those very flimsy seats that are attached to movable walls or coat closet-type——

Ms. KAUFMANN. Mr. Levitas, as long as you are talking about jumpseats there is one area that I would like to bring out. While jumpseats are used on the ground, for takeoff and landing as jumpseats, as emergency door seats, they are also used in the air as rough air seats for the cabin attendants. On a full load that is the seat that we have to go to. Or if we have a decompression on a full load that is the seat obviously that we would be taking.

Once again, getting back to the Lockheed 1011, I am not attacking the airplane, I think it is a wonderful airplane, but there are some problems on it. Back in the coach cabins at the Nos. 2 and 3 doors we park two-aisle serving carts on mushrooms. Mushrooms are little safety locking devices in the floor. On these, we park the carts on these mushrooms. It makes the jumpseats inoperable as rough air seats.

We have taken pictures of these seats. We have called the FAA out, as a matter of fact, for instance, in Boston last summer, and tried to get the flight grounded. Fortunately for the company there were a few spare passenger seats so the FAA said the airplane will go. You can use the passenger seats as rough air seats but we took pictures of the seats with the mushrooms, I am sorry, with the carts on the mushrooms. And proved to the FAA that the seats, as you know, the seats pop up. When the seats are down, they are not completely down and that we couldn't even use them.

When I wrote to the FAA I got a response back and they said straddle the seats. I wrote them a letter and I accused them of, to use a quote, "the most egregious example of bureaucratic fumbling I have ever seen in my life" because they were also talking about a center galley seat that I wasn't even talking about.

My response from them was and I will be happy to submit the letter for the record, was to stop writing them letters that continued to criticize them and that were unprofessional. They didn't like my words "egregious example of bureaucratic fumbling." To this day we still have the problems. It is still being written up. I am still going across the street to the company saying "get that cart off the mushroom because we don't have jumpseats for our people to use as rough air seats and we are going to start grounding your flights this summer to Europe when they are full and we cannot use the rough air seats."

But the FAA is simply not interested in doing it. That is our own principal operations inspector in Kansas City.

Mr. LEVITAS. I would like to receive copies of that entire correspondence. And by the time we are finished with this, I am sure they are going to consider your words to be very mild admonitions to them.

Speaking of those carts that are attached to the mushrooms, have you ever heard of any of them breaking away?

Ms. KAUFMANN. Oh, absolutely.

Mr. LEVITAS. What happens when that occurs?

Ms. KAUFMANN. Well, if the carts are parked perpendicular to the aisles of the airplane basically nothing happens unless you have a lateral roll. There are times though when the carts do tip over. They are not stable carts. They can tip over. They are very, very heavy carts. If they are loaded with food, chances are they are not going to tip over. If they are about half full yes, they will tip over and they will injure somebody.

It is generally a flight attendant who is standing there and who will be injured. The carts also have a locking device when not parked on a mushroom. When rolled up and down the aisle they can be locked with a foot brake or hand brake depending on the design of the cart. The brakes' integrity has never been, I don't know how to get out of this one. The integrity of the brakes has never been good. Yes, indeed, they do go sailing down the aisle, and with any sort of load at all, they weigh generally unloaded about 200 pounds, so if they hit somebody they really do injure a passenger if they are loaded.

And if they hit somebody it is quite a severe injury and yet they do break away. It is very easy.

Mr. LEVITAS. One last question at this point. Do the flights that you work on provide emergency breathing equipment for flight attendants?

Ms. MCKENNA. No, except portable oxygen bottles that are to be used in the case of decompression, in which we can walk around the cabin.

Mr. LEVITAS. But there are no smokemasks?

Ms. MCKENNA. No, sir.

Mr. LEVITAS. Is the same true for TWA, Ms. Kaufmann?

Ms. KAUFMANN. Yes, sir.

Mr. LEVITAS. Mr. Molinari.

Mr. MOLINARI. Have either of you ever been on an aircraft where there was a fire in the lavatory?

Ms. KAUFMANN. Not in the lavatory, no.

Ms. MCKENNA. I have not.

Mr. MOLINARI. I would like to talk for a moment with you about that certification procedure that you referred to on page 4 and following thereafter. Who was in charge of the test? Was there one person that day that had direct responsibility, overall responsibility for the test?

Ms. KAUFMANN. Are you asking if there was somebody at Lockheed directly responsible, or somebody at the FAA?

Mr. MOLINARI. No, who supervised the test? There must have been one individual in charge of the operation that day?

Ms. KAUFMANN. Well, in terms of the person we always turn to the arbiter of our disputes in terms of the best way to evacuate passengers, the person happened to be the principal operations inspector for Trans World Airlines. I don't believe that the POI from any of the other airlines participating was there.

Mr. MOLINARI. What was his name?

Ms. KAUFMANN. Robby Robinson.

Mr. MOLINARI. Is he still with the company?

Ms. KAUFMANN. He was with the FAA, sir. He is no longer our POI. I don't know if he is any longer employed by the FAA.

Mr. MOLINARI. You mention in here that there were TWA, Eastern, about five carriers that were involved in the certification procedure?

Ms. KAUFMANN. That is correct.

Mr. MOLINARI. Really, what you participated in was a farce, was a charade to get a desired result regardless of how they got that result. Is that a fair statement?

Ms. KAUFMANN. I couldn't have said it better myself.

Mr. MOLINARI. You are doing a pretty good job, I will tell you. You know, this is really incredible, to read this and to think in terms of the very people that we look to for some sense of responsibility to participate in what transpired here is really quite shocking. Maybe it shouldn't be shocking to us because we have heard some rather incredible stories already.

Ms. KAUFMANN. Mr. Molinari, just to add one thing to that. The next year the crew who participated in the U.S. carrier certification of the Lockheed, the very same crew was invited back to Palmdale to participate in the certification of Courtline's aircraft of the Courtline, a now defunct British charter group. The reason that airplane had to be certified is because there were instead of 350 seats they were certifying it with 450 seats. So it had to get another type certificate.

I think that it is telling that they invited back the same crew. I think it is telling that we managed to evacuate that airplane the first time out. They obviously wanted a crew who knew the ropes, who knew where the cameras were, who knew what the methods were and could get people out of that airplane, and we did. I don't think that speaks highly for the flight attendants that were involved. Including myself.

Mr. MOLINARI. I was going to make the same statement. You say it was the same crew.

Ms. KAUFMANN. Basically yes. They couldn't get everybody back there. I participated in it again as did some of the people from TWA.

Mr. MOLINARI. Of course we are looking at the prescribed time to evacuate is supposed to be 90 seconds, is that the target?

Ms. KAUFMANN. Maximum, yes.

Mr. MOLINARI. Maximum.

Ms. KAUFMANN. Yes.

Mr. MOLINARI. Given the unreal circumstances and desire to get home and the benefit of every doubt with the cameras pointed at the exit doors that would work, it was 82.7 seconds?

Ms. KAUFMANN. That is correct.

Mr. MOLINARI. What we are really saying then is under any normal set of circumstances, it would be virtually impossible to evacuate that plane in 90 seconds?

Ms. KAUFMANN. Well, as a matter of fact I think that the first exercise on day one of the U.S. carriers certification exercise was probably more realistic because the people had been in the airplane for so long. They were lethargic, they were tired, they weren't panicked but certainly in a certification process, and this is something we did speak with the FAA about once we had the debriefing on the certification and they ran the films for us and it was cute with everybody screaming and all this jazz but we said why don't you have smoke in the airplane? Why don't you have real bags in the airplane? Why don't you have little kids on the airplane?

Why do you have the old cloth-metal seatbelts instead of metal-to-metal, why do you have kitchen chairs taped to the floor? It is ludicrous. There is nothing realistic about it. There is no panic because there is not a fire licking at these people's heels. They haven't gone through this extroardinary trauma of an airplane landing and all of the attendant noise that goes with it.

I have evacuated a burning airplane before for real. I have to tell you, it was much, much different than it was in the certification exercise. The panic is the factor that is determinative of everybody's reaction.

Mr. MOLINARI. I would like to get to that real situation with you where you were involved in an evacuation of a fire. Let me see if we cannot pin this thing down a little better.

You did make a complaint? You asked questions about why they didn't have a real circumstance?

Ms. KAUFMANN. Yes, sir.

Mr. MOLINARI. In what form was that expressed, was this verbalized?

Ms. KAUFMANN. Yes, sir.

Mr. MOLINARI. Was it followed up by any written complaint?

Ms. KAUFMANN. No, sir, the only time that I have spoken about this since, with the exception of our former National Safety Director, was when he solicited from me my statement regarding the certification procedure that I understood was to be submitted for the record before another subcommittee, Government Operations.

Mr. MOLINARI. All right.

Ms. KAUFMANN. But in terms of complaining to the FAA about it, making any sort of written statement, telling anybody who had any sort of authority about it, we didn't. I wasn't as aware at the time.

Mr. MOLINARI. Is there any investigation that followed thereafter into the procedures that you went through here to secure certification?

Ms. KAUFMANN. Not that I am aware of, no.

Mr. MOLINARI. Would you have any present knowledge of the same kind of thing going on in certification procedures? This is 1975, or 1973 we are talking about. Then you mentioned 1974, the next year, they brought back the same crew.

Do you have any knowledge about what might have happened in succeeding years, or more importantly, the last few years?

Ms. KAUFMANN. The only thing that I know that has happened in the last couple of years are two things. Mini evacuations which I am not qualified to speak to and I think Bonnie is, No. 1. No. 2, we did make some effort when the FAA was attempting, not attempting, maybe is not the right word, talking about certifying the Boeing 767 by analysis, computer analysis. And that is as ludicrous as the exercise that I participated in back in 1973. I just don't believe that that is a fair way to certify an airplane for passengers. We were annoyed when we heard about it. We contacted a Member of Congress who was the chairperson of the Government Affairs Subcommittee. I think he managed to put a stop to it before it got started.

Mr. MOLINARI. Ms. McKenna, did you want to add to that?

Ms. MCKENNA. I cannot really speak well to the mini evacuation. I do know that it is just a matter of putting the flight attendants on a timed—to open the doors in 15 seconds. And there is no evacuation of people in these mini evacs. I have read where World Airlines was trying to qualify on their 747, a problem occurred where the Boeing people came out, had to oil the doors to try and get them to open quicker than they were supposed to. They have had quite a lot of trouble in these mini evacs. I am sure the study can be dug up and brought to light. I have read it so long ago now. It was several years back.

Mr. MOLINARI. On an average flight is there a testing of the doors and emergency lights on the plane?

Ms. KAUFMANN. In the average flight?

Mr. MOLINARI. Before a plane takes off, commercial flight?

Ms. KAUFMANN. No, sir, you don't check the doors nor test the lights. The cockpit would be checking emergency lighting because they have all, with the exception of the old Boeing 707's and 727's, there is a check. Basically the lights come on by inertia. In terms of checking the doors we preflight the airplane, at least we are supposed to preflight the airplane to check the slides——

Mr. MOLINARI. When you say we——

Ms. KAUFMANN. Flight attendants, yes, are supposed to preflight the airplane, check the slides, check the pressure guages, check the portable emergency equipment on the airplane. In terms of checking to see if the slides work obviously you cannot do that. Because if you open the door and the slide pops, you are going to sit there for 4 hours while they repack the slide. A lot has to do with visual checks and gauges.

Mr. Molinari. How long does it take to go through the checking procedure?

Ms. Kaufmann. Depends on the size of the aircraft.

Mr. Molinari. Give a minimum and maximum if you would.

Ms. Kaufmann. Bonnie is an active flight attendant. I would like to defer to her.

Mr. Molinari. Bonnie, it is your show.

Ms. McKenna. Speaking for myself, I think an adequate check where you walk through the airplane and virtually check each item and I fly DC-10's as the largest aircraft, takes approximately 5 minutes to walk around and open all the doors and make sure you have got all your oxygen, all your fire extinguishers, your first aid kits and make sure they are sealed in full. Also to check the lights. There is a light system on a DC-10 door which you can push to see if a bottle is charged for the door.

Mr. Molinari. Is there one person who is delegated with that duty to run that check?

Ms. McKenna. It is to be incumbent upon each flight attendant as she boards the airplane to check her emergency equipment.

Ms. Kaufmann. I would like to say as far as TWA is concerned on our wide-bodied aircraft, on the narrow-bodied aircraft, let me start there. Flight attendants check the entire airplane. Every flight crew member, cabin crew member checks the entire airplane, doors and emergency equipment. On the wide-bodied aircraft it has been divided off into zones. A flight attendant for instance who is working C zone is charged with checking out C zone, not the entire aircraft.

Mr. Molinari. I don't guess either one of you would be familiar with whether they observe these procedures in a shuttle flight when the plane has touched down for a very short period of time?

Ms. Kaufmann. With a crew change they certainly should. Every time a crew gets on the airplane they should preflight the airplane. Whether they have enough time to do it is another question.

Mr. Molinari. OK.

If we could get back to the incident you were involved in where you helped to evacuate a plane where a fire occurred, would you mind telling us what happened?

Ms. Kaufmann. It is so anomalous I almost hesitate to bring it up, but it was on a Lockheed 1011 in Los Angeles at the gate where the pilot started the No. 3 engine and blew up the engine, so he started an engine and wing fire.

The passengers on the right side of the airplane—we felt it and we heard it. However, we were standing, the crew was standing in the airplane where we weren't looking directly out of the window. Passengers who were sitting on the right side of the aircraft in the coach cabin saw the wing fire. They got up out of their seats and we knew that something was amiss.

However, before the Captain discharged the emergency alarm, passengers were running up the aisle trying to get their carry-on baggage out of the carry-on compartments, trying to get their garment bags out of the garment bag compartments, and bailing off the airplane through the jet way.

We obviously heard the evacuation alarm, the captain sounded the evacuation alarm. Because the fire was on the right side of the plane, we did not use any of the exits on the right side of the airplane. Because the jet way was pulled up to the L-2 door we couldn't use the L-1 door as an evacuation door, so passengers were evacuated either through the L-4 or L-3 door down-slides or through the jet way at L-2 door.

We only had a couple of injuries. They were slight injuries which, of course, one expects to have, and the fire was put out, frankly, before half the people were off the airplane.

Mr. MOLINARI. How many people were on the plane?

Ms. KAUFMANN. It was a full airplane. It was approximately 325 people.

Mr. MOLINARI. If you had to proceed to full evacuation that day, even though you were at the airport, could you estimate how much time it would have taken to get all those passengers off?

Ms. KAUFMANN. I beg your pardon. Would you repeat?

Mr. MOLINARI. How long would it have taken if you had to fully evacuate?

As I understand it, did you just say half the passengers were off the plane and the fire was already extinguished?

Ms. KAUFMANN. We evacuated all the passengers. It wasn't up to us to determine when the fire was out. We evacuated all of them. Probably because of the baggage problems, we had several problems. This was 1975. There were a lot of Vietnam refugees entering from the Pacific rim countries, and it was a night flight. Night flights, as you know, are a little different type of person than daytime flights. Passengers are a little bit different.

As a result, the Vietnam refugees were all put in first class where they had some space available. The people didn't speak English and let me tell you, when the airplane is on fire and alarms are going off where the Vietnamese people have had their little huts bombed, it is just another day and they weren't real interested in getting up out of the cabin, so we had to go unfasten their seat belts, get them up out their seats and get them out on the jet way.

The other passengers sort of held up the evacuation by virtue of the fact we had carry-on compartments that were shut and they wanted them open to get their bags and briefcases and garment bags, which were in a bulkhead, off before they decided to evacuate the airplane.

It probably took two minutes to evacuate the airplane.

Mr. MOLINARI. Two minutes?

Ms. KAUFMANN. Two minutes and that was with a fully lighted airplane with no smoke inside the cabin under probably the best of circumstances with the jet way pulled up.

Mr. MOLINARI. You raised a question about luggage, one that we have heard something about. There seems to be some concern over overloading of the overheads with luggage, with weight.

Could you comment as to what your own experience is with this particular question?

Ms. **Kaufmann**. Can I defer to Bonnie, please?

Ms. **McKenna**. We have had an accident in Denver where the coat closets were overloaded and tipped over on a flight attendant in the forward jumpseats and they were unable to get out of the airplane. We also have the same problems that Monica alluded to.

We do not have any way to estimate how much weight is being brought on board. In many of the cities we serve people bring garment bags on that are extremely heavy. I can't even believe they can carry them, and so your coat closets are overloaded in a matter of just maybe five bags. Our overheads are structured now so that they close down and you don't have to lift any weight up, although I do know that many aircraft, not with our company, are still in that mode where you would actually fill the bin up and then push it up into a latch. I know the bins do fall open because I have been on flights as a regular passenger where I have seen that occur, overheads open and baggage falls out on people's heads.

Mr. **Molinari**. From your perspective, what recommendations would you make? You have both had substantial experience with this question. What recommendations would you make with respect to the amount of luggage that is being carried onto a plane?

Ms. **Kaufmann**. We shouldn't even have to deal with it. We are the last people that passengers see once they get on that airplane. We shouldn't be bothered with it, and unfortunately we are because there are agents at the gate who should be the ones who are dealing with it, are too busy because there aren't enough of them, and they are not asking questions about carry-on baggage.

Generally they make a standard announcement that all carry-on baggage has to fit underneath the seat in front of you or in the overhead compartment.

TWA flies, TWA is an international carrier, and we fly across the Atlantic, and then from Europe back this way across the Atlantic. It is absolutely extraordinary to see what gets on an airplane, especially from the European countries and, of course, the European agents don't feel that they are compelled in any way to monitor the carry-on baggage situation because they are not under the jurisdiction of the FAA.

I am not sure that the FAA pulls that much clout with our agents on this end of it. Basically our people are too busy out in the terminal, and the baggage rolls down the jet way and comes to us. When we try to check it, we get a fight with passengers because they don't want it checked. Obviously they want it on the airplane with them or they would have checked it to begin with. If we can't properly stow it, they want it stowed in the lavatories, they want it stowed in the galleys, in empty seats, they want it stowed in the cockpit; if they are uncooperative, our last line of resort is to go to the cockpit and ask that the captain have it taken off the airplane.

If the captain chooses to allow it on the airplane and not take a delay, we are stuck. The only thing we can do is write it up to the company and cover ourselves by notifying the captain that there is excess carry-on baggage on the airplane and let him make the decision.

It should start at the gate. It should never get as far as the jet way, period.

Mr. **Molinari.** I anticipated your answer. I myself have witnessed it too many times, and I sometimes wonder how they do manage to fit on the plane that which is carried, but too often there is no question the interior of a plane that was meant to carry light luggage is loaded with some rather heavy luggage, and I think that poses a serious threat to the passengers, flight attendants, anybody on board.

I have no further questions. I think that I would like to pursue, talk to the chairman on this question of certification procedures to see whether they are doing the same kinds of things today. It is a rather shocking revelation, and your testimony is indeed something that is very welcome to us, and something that has to be given attention.

Thank you.

Ms. **Kaufmann.** Thank you.

Mr. **Levitas.** Thank you, Mr. Molinari. They are still doing the same things today and we have had a great deal of information about that. If you ever look at the number of exemptions that the FAA grants almost routinely exempting the requirement of full scale demonstrations, it is just again very shocking.

I guess that is getting to be an over-used word.

On the matter of smoking, what type of cooperation do you generally get from the company or the cockpit crew when you have trouble with a passenger who is smoking in the aisle or in a no-smoking section?

Ms. **McKenna.** Well, it is subjective because if it is in flight and you are having a problem with someone who will not obey what you ask him to do, if the cockpit member smokes, you find that you don't get very much cooperation. If they don't smoke, you usually get more cooperation.

The companies themselves are pretty careful about how they allow smoking because they can be fined so heavily through the lobbying efforts I guess of the ASH people that they are pretty attentive, trying to keep people who smoke out of the no-smoking zones, but, of course, once in flight you are confronted with a whole different ball game.

Ms. **Kaufmann.** I do concur with what Bonnie says. It has been our experience in any area that deals with safety, whether it is smoking in the aisles or the lavatories, excess carry-on baggage, abusive passengers, that—I really hate to say this because I am not trying to indict either the industry or the FAA, I did it pretty heavily today already, but we presently don't get the back-up that we need. Sometimes we get it from the cockpit and sometimes we don't get it from the cockpit.

That is a matter of personalities, but in terms of general company policy, we aren't getting the back-up or the support that we need because passengers who are annoyed with us when we are telling them, when we are throwing their bags off the airplane, we are trying to do it as nicely as possible and we are telling them to please sit down in a designated smoking seat while they smoke, or please stop hitting this other flight attendant, generally those passengers will complain either with a letter to the company or to an agent, once off the airplane, who will then turn around and write us up.

It has been our experience with our organization that we defend an unnecessary amount of passenger complaints in these areas, and the company always takes the passenger's word for it. Therefore, we are really misusing an awful lot of energy in an area of discipline, where the company is not saying we will back you up if you have a problem.

If this passenger hit you, yes, call the Federal authorities, call out the marshal, and we will take it to the U.S. Attorney and, no, you are not going to have to file a civil suit. TWA will be behind you.

I am sorry, you said air carrier; that is who I work for.

Unfortunately the flight attendant is out there on their own. What that means are flight attendants who simply give up, they don't fight the things they should be fighting. They don't fight the excess carry-on baggage on the airplane and they are a little bit timid on fighting about the smoking on the airplane. They are a little bit afraid they are going to get in trouble with the company. That is what it boils down to.

Mr. LEVITAS. That is what I was wondering, because that creates a problem beyond the fact that there are people smoking, because you are eliminating or dampening the enforcement mechanism to enforce these rules, because flight attendants, as a result of not getting adequate backup, just close their eyes and look in the opposite direction.

Ms. KAUFMANN. That is correct.

Mr. LEVITAS. When people go into the lavatories and smoke, and you have some idea that that is going on, do you do any particular things to get them to stop? They are in there. The door is locked. What do you do?

Ms. KAUFMANN. I think Bonnie can answer this as well as I, and I am interested to hear her answer. I think she probably has some more stories. We do several things. We can open up the lavs with can openers. We attempt to be courteous to begin with and knock on the door and say, "Would you please come out with a cigarette" and we are generally ignored.

You have to remember one thing. There are ash trays on the lavatory doors and there are ash trays inside of the lavatories. Obviously meant for people to put out their cigarettes. People on the other hand feel that the ash trays are there as a permissive device to allow them to smoke, so when we are on one side of the door trying to get them out of there, they are just opening up the ash tray, getting ready to enjoy their cigarette.

I have heard of some very creative ways to get people to stop smoking. We will open up the door on them.

I was delighted to hear Captain Ashwood say that flight attendants can really handle their weight back in the cabin and we do. We will pull passengers out bodily and take a cigarette away from them. I have heard of flight attendants getting a water fire extinguisher and simply letting a passenger have it when that passenger has been so stubborn, shall we say, about putting out a cigarette, insisting upon smoking in the aisle or in the lavatory.

I think there are a number of ways to go about it, and it really is a matter of how far you want to take it, and if you really want to push it.

Mr. **Molinari**. Could you please tell me how you know that somebody is smoking when they are in the lavatory and the door is locked?

Ms. **Kaufmann**. You can smell it coming out of the lavatory. Those doors are not exactly air tight. They are meant to be broken down with a kick, if need be. They are honeycomb doors. You can smell cigarette smoke coming out of the lavatory.

When somebody is smoking grass, you can definitely tell with that acrid, pungent odor. Basically you see a passenger strolling down the aisle walking into the lav and he or she has managed to walk in there before you catch up with them.

Mr. **Molinari**. If that would be the case, it would seem to me they had probably pretty well finished smoking the cigarette before you know there is smoking going on.

Ms. **Kaufmann**. Sure.

Mr. **Molinari**. Thank you.

Mr. **Levitas**. Ms. McKenna, would you care to add to that?

Ms. **McKenna**. I always tend to take a little more different tack after I have knocked on the door and they don't come out. I pound on the door and wait for them to come out. I don't mean to embarrass them particularly, but after you have asked them to put their cigarettes out and they don't, it is a fire hazard in there. There is too much paper and there is an air vent and we have heard all of the stories on that kind of thing, and I come from a family of firefighters, and I just don't want to find myself confronted with an Air Canada incident, and I make my passengers usually remember it.

Mr. **Levitas**. How do you do that?

Ms. **McKenna**. Well, I usually pound on the door and make a little scene there, and when they come out everybody in the area knows they have been smoking in there. There is a big sign that says "No Smoking in the Lavatories." They are told that when we take off, and there is a no smoking sign in the lavatory, so I would really say that unless a person was totally blind or, could not read, that would be hard to say they weren't aware that the lavatory is a no smoking area.

Mr. **Levitas**. The problem of baggage, carry-on baggage, I know is a real one from many particulars. Speaking as a passenger, you are caught between a rock and a hard place.

You don't want to lug all that baggage around just because it is inconvenient. But then you do want the baggage with you when you arrive wherever it is you are going, and sometimes that doesn't happen.

I know recently on four out of the last five international flights I have taken, I arrived where I was supposed to be and my bags were several days late arriving. Four out of five times, so it gets to the point if you want to have a clean shirt, you want to carry it with you rather than check it through. I just make that observation.

One last question that I had is on the training aspect that we got into a little bit yesterday.

Would each of you comment as to the matter of real world hands-on training for emergency situations and the use of emergency equipment?

Ms. McKENNA. Well, when I think back on our training, our company used to give us very, very good training, and I can only think that my training today is good because of the previous time, but once deregulation came into effect, and economics in every facet of the airline industry became more apparent, training was cut down from the hands-on actual operation of the emergency equipment to movies and vido demonstrations we still have to go by the prescribed number of hours that the FAA does set aside. For instance, the fire extinguishers that I alluded to before, they are out on a table, we pick them up and go through a verbal drill, like this is the gauge and it should read at this point, and if I was going to be using a water fire extinguisher, I explain how I turn the handle and how I approach the fire.

After you do this a number of times in a classroom, it gets very repetitious, and the tendency is to get through all of this as fast as you can because you want to get on the freeway and beat the traffic home.

It isn't as realistic as it should be, as it could be.

Ms. KAUFMANN. At TWA once a flight attendant is a line flight attendant, a qualified flight attendant, he or she is expected to complete 6 hours of recurrent training every year. It is called the annual emergency review. During that 6 hours, it is strict safety retraining, with some hands-on of fire extinguishers and emergency portable oxygen bottles. We do not extinguish fires. We simply fire the extinguishers into an empty trash can. We open cabin doors in mock-ups. If we are international-qualified, we will sit on the edge of an inflated life raft, and try to figure out what is zipped up in the center and sometimes we are blindfolded and we have to try to find it.

In terms of the initial training, and I am talking about initial for becoming a line flight attendant or if one is transferred to another division, for instance, from domestic to international where you have to ditch qualify, ditch training is conducted in a swimming pool. It is not easy. However, it does not in any way simulate what actual ditching is like, and we are all very much aware of it because it is a warm swimming pool that is basically placid, and it turns into sort of a fun afternoon.

We are not in a rough, choppy sea with an airplane sinking next to us. I am not sure that there is any other more practical way to do it, to be honest with you.

Our training is basically good. It is adequate. I wouldn't describe it as anything more than adequate. I think that there are more realistic things that we can do, and, as Captain Ashwood said, we have seen the same ditching film that they have seen for 40 years backwards and forwards 16 times, and after the fourth time we stop looking at it.

We basically are reading a book to a little light, anything that we can get our hands on.

The training, there is not enough hands-on training. There is not enough participatory training. There is not enough stress training that would really make us cognizant of what can happen once we are out on the airplane.

It is just a matter of boy, let's go out and pass the AER and get out of here for another year.

If I had my training today, my emergency review, my current training today, and TWA introduces a new piece of portable cabin equipment, emergency equipment, tomorrow, I will receive a bulletin on it. I will not actually see it or get hands-on training unless I fly that airplane. I won't see it. I won't actually receive hands-on training until the next year when I go back through my recurrent.

Mr. LEVITAS. Have either of you participated in training dealing with evacuation in smoke-filled simulated situations?

Ms. KAUFMANN. I haven't.

Ms. MCKENNA. Our company did attempt to do that, but the smoke made everyone cough so bad that they turned the smoke off and that has been the last time we have ever seen smoke. I think it was baby powder or something that was used, and it created such trouble with the flight attendants they stopped it.

Mr. LEVITAS. I would like to thank both of you for participating. Your testimony has been extremely helpful.

As I said at the outset of your testimony, the critical safety role that is played by flight attendants is one which we are well aware of, but it is obvious that there isn't nearly enough attention given to it. To that role in real terms by the FAA in its regulatory efforts, or even by the carriers in their training programs, and in backing you up in doing what you are supposed to be doing to discharge that responsibility, and I think that this is an area that we will be pursuing further during the rest of these hearings.

Thank you so much for being here today.

Ms. MCKENNA. Thank you.

Ms. KAUFMANN. Thank you.

Mr. LEVITAS. The next witness is Mr. Matthew H. Finucane, executive director, Aviation Consumer Action Project.

Mr. Finucane, if you would come forward, you may proceed as you so desire.

TESTIMONY OF MATTHEW H. FINUCANE, EXECUTIVE DIRECTOR, AVIATION CONSUMER ACTION PROJECT

Mr. FINUCANE. Thank you, Mr. Chairman. I want to thank you for the opportunity to testify before you today on the issues of cabin safety.

While I am going to talk about aircraft fires, I am also going to address the areas of seat strength and crashes into water since, as the chairman has noted, it is important to continuously pursue all aspects of cabin safety, not just the aspects raised by the last accident.

It is unfortunate that the FAA has deftly diverted some of the criticism of its inactivity in the cabin safety area through what one reporter called a "magic show" up at the Tech Center a few weeks ago. For those of us who have seen that magic show several times before, it seems more like a magic trick to hide unnecessary delay.

Let's look at fire blocking layers, for example, which were such a big hit up at the Tech Center.

As early as 1981, the FAA announced in a press release that full-scale tests showed that fire blocking layers would give passengers an extra 50 seconds to evacuate a plane. An extra 50 seconds is a tremendous increase in the current evacuation time of 90 seconds or less, and the FAA should have required the airplanes to install these covers at that time.

Why didn't the FAA issue a notice of a proposed rulemaking? According to a 1981 FAA press release, the difficulty is not just a matter of finding a less flammable material, but the need for the material to be light weight and cost effective.

In other words the FAA has taken this long to issue an NPRM because it was worried about imposing costs on the airlines.

The material which the FAA apparently thought was too heavy, and hence would require too much expensive fuel to cart around, was the Du Pont neoprene blocking layer called Vonar 3. According to the FAA release, this would have added 2 or 3 pounds per seat, so Vonar 3 was apparently discarded as an immediate solution while the FAA pursued lighter seat covers called Celiox and Norfab.

Now that the agency is sure this lighter material works, they are finally going to issue an NPRM. We think that is the opposite of the way they ought to work. Once they were sure that there was a product, ready and available and that it really worked, it should have gone directly into rulemaking. You can bet that if the agency had proposed a rule in 1981, the industry would have developed light-weight fire-blocking layers on its own by now.

Instead, we are only now embarking on what the FAA seems to be indicating will be a multiyear rulemaking process followed by a multiyear retrofit program.

This could mean another 5 years or more before some planes are fitted with these fire-blocking layers, clearly an excessive delay when an average of 30 people die each year in post-crash fires. Rule making under the APA can be completed in a matter of months if an agency wants to do it. And economics is no excuse for simply allowing the existing seat cushions to wear out before putting new improved ones in the aircraft. We believe that the agency can and should require the immediate installation of these layers after the briefest possible rulemaking period.

Placing a fire-blocking layer on an aircraft seat, I should point out, is no more difficult than putting a slipcover on your couch. It is simply inserted between the cushion and the upholstery or as a substitute for the upholstery, and I called one of the manufacturers yesterday and they indicated that they could run 200,000 of these things out within a year.

Solving the problem of aircraft seats though is only a part of the overall problem of cabin fires.

As you know, there are no overall standards governing the amount of smoke and gas that can be given off by other cabin materials that can contribute to the fire, such as the lavatory walls.

Ten years ago our group formally petitioned the FAA to set standards governing smoke and gas emissions. We filed that petition with the widow of a passenger who died in a crash in 1972 at Midway airport. That passenger received no fatal injuries, but was killed almost instantly by the inhalation of smoke and fumes.

The FAA's response to our petition was that more research was needed. Ten years later there are still no standards, and the FAA is still doing research.

They are still doing research even though NASA has developed standards that screen for materials such as advanced phenolic panels that do well in both containing fires, and in producing low amounts of lethal gases.

They are still doing research even though the FAA paid McDonnell Douglas $400,000 to come up with standards in this area, which they did. The FAA said it was a good job, but it wasn't the "final answer."

And the FAA is still doing research, even though one manufacturer, Boeing, has gone ahead and set its own design goals for smoke and gas for its new planes. These new aircraft have some of the advanced materials that were suggested by the NASA research.

Given these advances and all the work that has been done in this area, it is extremely disappointing to us that the FAA has not developed standards by now in the smoke and gas area. If you consider the fact that the FAA admits that their flammability standard doesn't represent actual fire conditions, you are confronted with what amounts to a complete regulatory failure to cover the materials that go into the plane in terms of their fire characteristics.

We urge you to carefully evaluate the FAA's pace in this area. You might want to use as a benchmark the SAFER Committee, which was really very conservative in many ways and on which we served, which said that one procedure, the Ohio State University Chamber, should have been developed enough by late 1982 to be used in setting standards by the FAA.

Speaking of that committee, whatever happened to some of its other recommendations? SAFER recommended rules requiring fuel tank vent protection within 12 months. There hasn't been a word out of the FAA on that one, and it is now 3 years later. SAFER recommended requiring automatic fuel supply shutoff in fire situations. Three years later there is no NPRM on that recommendation either.

SAFER also recommended the Bunsen burner test be immediately upgraded to account for certain cabin materials. This project has been abandoned by the FAA as far as we know.

The only SAFER short-term recommendation that has been implemented was to issue standards requiring better, more fire resistant slides. But, as you heard from the chairman of the NTSB on Tuesday, that requirement does not include retrofitting. You can keep those slides in the place the way they are now for as long as they last, and I am sure they last 10 or 15 years, if not for the life of the plane.

So, in spite of that Technical Center presentation, I think it is safe to say there have been no major improvements in cabin fire safety in the last several years, and there probably won't be any in the next 2 or 3 years, depending on how rapidly the FAA moves with their fire blocking layer.

There are many other things which the FAA could do to reduce the fire hazard on board aircraft, and I would like to briefly mention a few. First, FAA could install smoke alarms in the lavatories and galleys. This is such an obvious move that I don't think I will elaborate on the justification.

One point I would like to make is that when the NTSB recommended these smoke alarms in 1973, the FAA's response was to beef up lavatory inspections. In light of the Air Canada crash, we believe the theory that crew inspections of the lavatories is sufficient to ensure early warning has been proven wrong in practice. By the time the fire was noticed, it was apparently too late.

Second, smoke hoods should be explored more aggressively for passengers. Although there was concern in the past that you could suffocate in these, it has been clear for many years that you could run the smoke hoods off an independent air supply.

I would like to turn briefly to aircraft seat strength. As you know, the standards were written in 1952 and allow the seats to be less strong than car seats, less strong than your body and less strong than the surrounding aircraft structure. In many low-impact crashes the seats, therefore, break loose, propel you about the cabin, crush the passengers, pin them and block the exits.

The FAA's own staff has in 1969 and 1978 recommended upgrading these standards. The NTSB has been calling for improved standards since 1962. In its most recent report on the subject, the Board said that no further research was needed before improved standards could be written. Unfortunately, the Board noted that the FAA plans to continue research and that at its current pace we probably won't see better seats until the year 2000. This is just unacceptable.

There is, incidentally, an interim solution in this area. A dynamic test was proposed by the Simula Corp. which publishes the Army Crash Survival Guide. This dynamic test was endorsed by the NTSB in its 1981 report. It has also received the backing of Joseph Haley, a leading expert in the field, who helped write the original Army Survival Guide. If the committee could do anything to support the interim measure, that would be appreciated.

Frankly, I was amazed a few weeks ago to hear the Administrator of the FAA say that seats couldn't be made stronger without making them more rigid, thereby transferring the load to the passengers. When his predecessor came before this very subcommittee in 1980 and said the same thing, the chairman of the subcommittee wrote him a critical follow-up letter afterward.

Langhorne Bond wrote back and conceded, "impact resistant and energy absorption can both be designed into seats and strength and rigidity are two different engineerring concepts." So, I would be wary of hearing the same old excuses from the FAA such as the floors are weak or the human body can't withstand greater crash forces. All you have to do is look at some of these crashes where the passengers are surviving and so is the aircraft structure, but the seats are all over the place, to realize that what is really going on is that the agency is making excuses essentially to avoid imposing the costs of what they think might be heavier seats and seats that would require development and testing.

Finally, I would like to discuss crashes into water. The Air Florida crash and Eastern L-1011 incident on May 5 have once again raised the question of how well we are prepared for a crash into water. The answer is that we are very poorly prepared. Unless you are going 50 miles from land, you are often only going to have seat cushions which expose you to hypothermia, and ran lose flotation after 15 minutes. The Coast Guard says children and non-swimmers shouldn't use them. So they are really not going to be of much help to you.

You also should realize that help is not going to be on the way if you go into the water because under FAA regulations the airports aren't required to have airport water rescue planes or water rescue equipment. The Air Line Pilots Association urged placing vests on all aircraft traveling to and from airports with large bodies of water in the approach and departure path. That is over 200 airports in the United States.

This proposal was turned down by the FAA on cost grounds, we believe. The FAA did a cost-benefit analysis. The analysis concluded that based on prior accident statistics, "at most .53 lives per year could be saved by equipping air carriers with extended overwater survival gear. The statistical valuation of this benefit is $283,000 per year. * * * The potential benefits are minuscule when compared to the cost associated with equipping the fleet."

I think that remark deserves close examination by the subcommittee since it shows how things never really change at the FAA. As you will recall, the Blue Ribbon Committee on Aircraft Certification and the GAO report both said the problem with the FAA is they only respond when there has been an accident. The FAA's cost-benefit analysis is just another way of saying the same thing. They are saying "Until there is a jumbo jet going into an icy lake and you lose a couple hundred people from drowning, the statistical benefits from having life vests are not going to outweigh the costs." They are not going to address the known hazard, crashes into water, with the known solution until the statistics change.

In any event, the statistics have changed on aircraft fires as a result of the Air Canada crash. We hope the subcommittee can at least drive those figures home to the FAA.

Thank you very much.

[The prepared statement of Matthew H. Finucane follows:]

STATEMENT OF MATTHEW H. FINUCANE
EXECUTIVE DIRECTOR OF THE AVIATION CONSUMER ACTION PROJECT
BEFORE THE
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT
HOUSE COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION

AIRCRAFT CRASHWORTHINESS: FIRES; SEAT STRENGTH; AND CRASHES INTO WATER

JULY 14, 1983

Thank you for this opportunity to testify before you today on the issues of cabin safety. ACAP is a non-profit consumer group founded by Ralph Nader in 1971 to promote passenger safety and rights.

Over the last ten years ACAP has filed several formal petitions in the cabin safety area, most notably a 1972 petition for nitrogen-inerting of fuel tanks, a 1973 petition for standards limiting smoke and gas emissions from burning cabin materials, and a 1977 petition for stronger and more energy-absorbing seats and for dynamic testing of seats. ACAP also served on the Special Aviation Fire and Explosion Reduction (SAFER) Committee, which in 1980 recommended to the FAA a series of steps to reduce the hazards associated with aircraft fires, in particular post-crash fires.

In our testimony today we will focus on some of the important improvements that still need to be made today. We will also, where appropriate, analyze some of the FAA's delays in this area to see if we can offer some insights into how future delays might be prevented.

FIRE-BLOCKING LAYERS FOR SEATS

While many people were impressed by the FAA's demonstration of its fire safety research at the Technical Center a few weeks ago, those of us who have seen the "magic show" several times before are beginning to wonder if it isn't just a "magic trick" to hide unnecessary delay. The last time I saw the Technical Center slide presentation on seat blocking layers and other items was in June, 1982 at a technical meeting here at FAA headquarters in Washington. I stood up at the end and asked whether, since the fire-blocking layers worked so well, there was a timetable for actually requiring them. I was assured that there was one, although no one was willing to say or was sure what it was.

This was surprising, since as early as December 1981, the FAA had announced in a press release that full-scale tests showed that fire-blocking layers would give passengers an extra 50 seconds to evacuate a plane. An extra 50 seconds is a tremendous increase in the current evacuation time of 90 seconds or less and the FAA should have required the airlines to install these covers at that time.

Why is the agency only now preparing a notice of proposed rulemaking? According to the 1981 FAA press release, "the difficulty is not just a matter of finding a less flammable material, but the need for the material to be . . . lightweight and cost-effective." In other words the FAA has taken this long to issue an NPRM because it is concerned about imposing costs on the airlines.

The material which the FAA apparently thought was too heavy, and hence would require too much fuel to cart around, was a Dupont neoprene blocking layer called Vonar III. According to the release, this product would have added two or three pounds per seat. So Vonar III was apparently discarded as an immediate solution while the FAA pursued lighter seat covers called Celiox and Norfab (aluminized fabrics used in steel mills as a replacement for asbestos suits and gloves). Now that the agency is sure that the lighter materials work, they are going to issue an NPRM.[1]

We think that this is the opposite of the way the agency should work. Once the agency was sure that there was a product available, and that it was a true life-saving device, it should have gone directly into rulemaking. You can bet that if the agency had proposed a rule in 1981 , the industry would have developed light-weight fire-blocking layers on its own.[2]

Instead, we are only now embarking on what the FAA seems to be indicating will be a multi-year rulemaking process followed by a multi-year retrofit program. This could mean another five years or more before some planes are fitted with these fire-blocking layers -- clearly an excessive delay when an average of 30 people die each year in post-crash fires. Rulemaking under the Administrative Procedure Act can be completed in a matter of months if an agency so desires. And economics is no excuse for simply allowing the existing seat cushions to wear out before putting new, improved ones in the aircraft. We believe that the agency can and should require the immediate installation of these fire-blocking layers after the briefest possible rulemaking period.

---

[1] In addition to proving that lighter fire-blocking layers would be successful, the FAA also reached another conclusion that gave the industry an incentive to accept these fire-blocking layers; the fire-blocking layers may work just as well in conjunction with the lighter non-fire retarded urethane foams as with the current heavier fire-retarded urethane foams. Thus, some of the additional weight of the fire-blocking layers may be offset by using non-fire retarded cushions. ("Optimization of Aircraft Seat Cushion Fire Blocking Layers", NASA Ames, p. 26 (March, 1983)).

[2] As the Subcommittee will recall from its 1980-81 hearings on post crash fires, Boeing responded to the issuance of a 1974 NPRM on smoke and a 1975 NPRM on toxic gas emissions by setting out to develop safer materials without waiting for final rules to be issued.

STANDARDS FOR FLAMMABILITY, SMOKE AND GAS

Ten years ago ACAP formally petitioned the Federal Aviation Administration to set standards governing the amount of smoke and toxic gas released by burning cabin materials. We filed the petition along with Mrs. T.G. Baldwin, the widow of a passenger, Mr. T.G. Baldwin, who died in a crash of a United Airlines 737 at Midway Airport on December 8, 1972. Mr. Baldwin received no fatal injuries as a result of the crash, but was killed almost instantly by the inhalation of smoke and poisonous fumes.

The FAA's response to our petition was that more research was needed. Ten years later, there are still no standards, and the FAA is still doing research.

The FAA is still doing research even though NASA has developed smoke and gas standards that can screen for materials, such as advanced phenolic panels, that do well in both containing fires and in producing low amounts of lethal gases.[3] Incidentally, in one test a virtually fire-proof lavatory was made with these advanced panels.

The FAA is still doing research even though McDonnell-Douglas came up with standards for fire, smoke, and gas under a $400,000 contract with the FAA. The FAA said it was a good job, but was not the "final answer."

---

[3] "Fireworthiness of Transport Aircraft Interior Systems," John A. Parker and D.A. Kourtides, NASA Ames Research Center, AGARD Lecture Series No. 123, "Aircraft Fire Safety", (June 1982).

And the FAA is still doing research even though one manufacturer, Boeing, has gone ahead and set its own goals for smoke and gas for its new 757s and 767s. These new aircraft have some advanced panels similar to those suggested by the NASA research.

Given these advances, and all the work that has been done in this area, it is extremely disappointing that the FAA has not developed standards in the smoke and gas area. If you consider the fact that the FAA itself admits that its current standards for flammability are not representative of actual fire conditions, you are confronted with what amounts to a total regulatory failure to deal with the safety of cabin materials in a fire.

We therefore urge this subcommittee to find out when the FAA plans to finish its research into smoke and gas standards, when it plans to translate that research into regulations, and when those regulations will actually result in the installment of new materials throughout the fleet.

As a benchmark in evaluating the FAA's pace, the subcommittee might look to the 1980 SAFER recommendation that the FAA:

> Expedite the development of the Ohio State University (OSU) chamber and evaluate its use. If successful, this would provide a standardized test for materials which would account for flammability, toxicity, and smoke. The Committee expects that this development could be completed by late 1982, at which time its use should be considered for incorporation in FAA's fire airworthiness rules.

The SAFER committee has been described as "150 of the world's top experts in fire research, operations, accident investigation, materials development, systems design and aircraft fire and occupant safety." While there are obviously great difficulties in relating large scale fires to small scale tests, the fact that the SAFER committee felt in 1980 that standards might realistically begin to be written in 1982 should be given great weight in this Subcommittee's deliberations.

OTHER "SAFER" COMMITTEE RECOMMENDATIONS

The SAFER advisory committee made several other recommendations in its final report on June 26, 1980 that seem to be going nowhere fast, despite promises from the FAA that it would comply with the Committee's recommendations.

> The SAFER committee recommended that the FAA:
>
> Amend FAR Part 25 to require fuel tank vent protection during ground fires by adding a new paragraph 25.975(a)(7) to read: "Each vent to atmosphere must be designed to minimize the possibility of external ground fires being propogated througn the vent line to the tank vapor space, provided that the tank and vent structure remain intact." The Committee recommends that this action to amend FAR 25 begin immediately and be completed within 12 months.

It is now three years later, and the FAA has yet to even issue a notice of proposed rulemaking in the fuel vent tank protection area.

The SAFER committee recommended that the FAA "Amend FAR Part 25 to require design practices that maximize the probability of engine fuel supply shut-off in potential fire situations." It is now three years later, and the FAA has yet to begin rulemaking in this area.

The SAFER committee recommended that the FAA amend the bunsen burner flammability test to account for the melt and drip-away behavior of certain materials. This project, as far as we know, has been abandoned by the FAA.

Perhaps the most important SAFER committee recommendation was for the continued development of antimisting kerosene. According to the committee:

> The Committee supports the FAA planned target date of 1984 for the establishment of the data base for initiating rulemaking procedures.

We hope that this Subcommittee will closely address whether this project is still on schedule for as we have seen once again in Cincinnati, safety delayed is safety denied.

SMOKE ALARMS IN LAVATORIES AND GALLEYS

The installation of smoke alarms in lavatories was first proposed by the National Transportation Safety Board in 1973 after an in-flight lavatory fire killed 124 people aboard a Varig plane near Paris, France. The FAA's response at that time was that more frequent inspection of the lavatory area by flight attendants would diminish the possibility of lavatory fires, an approach which was apparently agreed to by the Board at the time.

In light of the Air Canada fire, we believe that the theory that crew inspection of the lavatories is sufficient to ensure early warning has been proven wrong in practice. By the time the fire was noticed, it was apparently too late.

Flight attendants have many obligations and cannot constantly be monitoring the lavatory. Moreover, fires in a lavatory can spread rapidly since, with the exception of the receptacles, cabin materials meet only what the FAA has itself admitted is an inadequate flamespread test. Burning materials are also aided by forced ventilation in the lavatory for odor prevention.

The Air Canada fire and the Varig crash both seem to highlight the fact that the trash receptacles in the lavatory are not the only possible ignition source. Thus, the fireproofing of the lavatory receptacles, even if this were adequate to prevent trash fires, is inadequate to prevent all fires in this enclosed area.

Since the majority of in-flight fires begin in the galley area (92 between 1959 an 1973), it would also greatly increase safety to place smoke alarms in the galley areas.

A BAN ON SMOKING ABOARD AIRCRAFT

Since smoking aboard aircraft could reasonably be banned for *either* health or safety reasons, the combined risks create an irrefutable argument for its elimination.

The health risks of smoking to both the smoker and the non-smoker are well known, and are exacerbated in the cabin environment where fresh air is lacking, the humidity resembles that of a desert, and in some cases ozone penetrates the cabin. Some flight attendants have reported that they spend their time walking up and down the aisles in a "blue haze." Moreover, as an economy move, some fresh air pacs off the engines have been turned off during flights on jumbo jets.

The fire hazard of smoking comes from two sources, the cigarette itself and the lighter/matches used to ignite the cigarette. Given the agency's known dissatisfaction with its own flammablility standards for cabin materials, the risk of a fire started by a smoker remains a hazard in the aircraft, particularly if an intermediate source of fire, such as a newspaper, is ignited.

SMOKE HOODS

Given the FAA's slow pace in reducing aircraft fire hazards, one solution that has been proposed is a smoke hood for passengers. This hood would give passengers a few minutes to escape a fire. The current oxygen system on board an aircraft is not useful to the passenger, since it cannot be detached and also mixes in cabin air (presumably filled with smoke and gas).

In January, 1969 the Federal Aviation Administration proposed that air carriers provide smoke hoods to passengers, a proposal that was withdrawn as a result of airline opposition. The FAA's action to terminate the rulemaking proceeding was strongly objected to by the FAA's own Office of Aviation Medicine.

According to R.G. Snyder in "Advanced Techniques in Crash Impact Protection and Emergency Egress from Air Transport Aircraft" (June, 1976), the historic reasons for industry objections to smoke hoods have been "cost, pilferage, and the hazards of too long use." The latter concern relates to the fact that you are simply rebreathing the air in the hood. In addition to these concerns, industry commentors have also expressed concerns over the increase in evacuation time resulting from passengers attempting to put the hood on.

In 1976, Snyder wrote that smoke hoods had advanced to the point where their "demonstrated merits far outweigh any potential risks or problems" citing, in particular, an easily donned hood developed by Sheldahl Company (Model S). Snyder also noted that more advanced smoke hoods were being developed with self-contained air supplies and that this would remove the problem of suffocation in the hood.

If an air supply were contained in the hood, the only remaining obstacle would be the potential delay created by passengers placing the hoods over their heads. With proper passenger education, standardization of the smoke hood, and simplification of the donning procedure, this is a problem that might be overcome and should be explored more aggressively.

PROTECTION OF THE CREW

If the FAA wants pilots and flight attendants to risk their lives in fires to save passengers, the agency should work to make sure that the crewmembers have the means to do so through protection from fire.

Unfortunately, as a part of "deregulating" the Federal Aviation Administration, the current Administrator has withdrawn an earlier FAA proposal to set standards for the flammability of crew member uniforms. Less flammable uniforms are needed and are within the state of the art, and these should be made available to the flight attendants.

In addition, flight attendants should have smoke hoods with an adequate air supply to allow them to assist in the evacuation. Current breathing systems provided to the pilots should also be evaluated to ensure proper fire protection.

FIRE-HARDENED WINDOWS

Present aircraft window systems shrink when exposed to an external fire, and allow the fire to enter the aircraft well before the airframe structure fails. NASA and others have tested windows (high-char-yield epoxy trimethoxyboroxine transparent polymer systems) that will last six to ten times longer than the present windows.[3]

While some additional development of these windows is apparently needed to ensure functionality, we once again wonder whether it would not be possible to begin rulemaking now, since rulemaking takes several years, rather than waiting for perfection of the product in a few years and then commencing rulemaking.

These are only some of the important steps that could be taken in the fire-safety area. I'm sure that other witnesses will be pointing out other important steps.

Yet the post-crash fire is only part of the lethal cabin environment, which also includes seats that break loose and flotation devices that do not work.

STRONGER, ENERGY-ABSORBING, DYNAMICALLY TESTED SEATS

A 1981 NTSB report documented 1,850 injuries or deaths in 77 survivable or partly survivable accidents during the

---

[4] Parker, supra n.2 at 5-7.

preceeding ten year period. Forty-five of these accidents involved failures of cabin furnishings, usually seats.[4]

Typically, the seats break loose from the floor, propelling passengers about the cabin, pinning them, and blocking aisles.

One reason that passengers are injured or killed in crashes involving survivable forces is that the seats, designed to FAA standards written in 1952, are very weak compared to the strength of the human body, and fail under forces the human body can withstand. This problem has been known for thirty years in the scientific community, and the FAA's own staff has on several occasions called for stronger seats as follows:

COMPARISON OF EXISTING STANDARDS WITH FAA STAFF RECOMMENDATIONS

	Current FAA	1969 FAA Aviation Medicine Recommendations	1978 FAA Mike Monroney Center Recommendations
Forward	9g	20g	18g
Downward	4.5g	20g	12.6g
Sideward	1.5g	10g	3g
Upward	2g	20g	5g

The 1969 FAA Aviation Medicine recommendations were made in response to the FAA's own Notice of Proposed Rulemaking 69-33 proposing increased standards for upward, sideward, and rearward forces. The 1978 Mike Monroney Center report recommended giving the airlines the option of using a dynamic test criteria, or the increased static test values described above.[5] The 1978 proposed standard would have allowed for energy absorbing seat design.

---

[4] NTSB, "Cabin Safety in Large Transport Aircraft," NTSB-AAS-81-2 p. 3, (September 9, 1981).

The National Transportation Safety Board has also recommended improved standards in this area. In 1962 the CAB (predecessor of the NTSB) concluded that seat failures in a September 23, 1962 low-speed ditching of a Constellation into the Atlantic prevented at least some of the 28 persons who died from escaping and told the FAA that "an increase in the minimum level (of crashworthiness) is long overdue." The FAA responded: "We concur with the views contained in (your) recommendation relative to adequacy of seat tie-down. We wish to assure you that the need for necessary studies relative to crash load factors and dynamic seat testing criteria is clearly recognized and that these studies are being expedited by our Aircraft Development Service consistent with available manpower and funds."[6]

More recently, the 1981 Safety Board report concluded that:

> Aircraft occupants are being injured and killed because of the failure of seat/restraint systems and other cabin furnishings in survivable and partially survivable accidents . . . There is sufficient data currently available regarding human tolerance and crashworthiness to demonstrate the need for and the feasibility of upgrading the applicable regulations.[7]

---

[5] Regulatory Standards and Analysis Branch, Mike Monroney Aeronautical Center, Initial Project Report, Energy Absorbing Seat Design, Project No. 70-599-120A, (August, 1978).

[6] Cited in NTSB 1981 Cabin Safety Study, supra, n.4, p.1.

[7] NTSB 1981 Cabin Safety Study, supra, n.4, p.1. These conclusions were published at about the time a petition by ACAP, the Association of Flight Attendants, and the Flight Engineers International Association for improved standards was denied by the FAA. The FAA claimed that further research was needed.

Given the recommendations of its own staff, the NTSB, and the scientific community, why is the FAA refusing to upgrade its seat standards? If the FAA has any lingering concerns over the feasibility or cost of placing stronger, dynamically tested seats in aircraft it need only turn to its own 1978 staff report which found that: (1) a survey of seat manufacturers showed that some currently available seat models are designed to withstand at least twice the forces required by the FAA standards;[8] (2) "confidence in dynamic testing has grown to the point where the U.S. Army specifies dynamic performance criteria for seats and safety belts;"[9] (3) "reliable dynamic test facilities are available [at four U.S. auto manufacturers and at six independent facilities] to aircraft seat manufacturers, in a quantity sufficient for minimizing costs of dynamic testing;"[10] (4) although initial development costs would increase (for seats designed to higher static standards or dynamically tested) "the increase would be amortized and likely produce only a small incremental unit cost increase;"[11] and (5) while the airlines contend that seat weight would increase and reduce payload or increase fuel costs if new standards were issued, "incorporation of absorbing features can reduce seat weight."[12]

---

[8] FAA 1978 Mike Monroney Center report, supra, n. 5, p. 31.

[9] Id. at 18.

[10] Id. at 18.

[11] Id. at 26.

[12] Id. at 26.

During hearings before this Subcommittee in 1980, the FAA staff explained its opposition to improving seat standards on the grounds that "it is simply not true that the human body has been shown capable of withstanding significantly more acceleration than current seats are designed to withstand."[13] This claim flies in the face of thirty years of scientific research and was subsequently retracted by the then head of the FAA, Langhorne Bond, in response to a critical follow-up letter from Congressman Mineta. Bond said "it is not the position of the FAA that human tolerance with lap belts is so low that strengthening the existing seat standards would be pointless."[14]

At the same hearing, FAA staff alleged that aircraft floors are so weak that there would be no point in improving seat strength.[15] In response to the same follow-up letter, Langhorne Bond retracted this statement and said:

> It is not the position of the FAA that current fuselage strengths are so low that any strengthening of the seat would be pointless. For airplanes presently in service, some local strengthening of the floor structure would probably be required if the static load factors were significantly increased. This would be within the present state-of-the-art and is technically feasible.[16]

According to the 1981 NTSB study on seats, the Army's Aircraft Crash Survival Design Guide provides detailed information on how to easily improve seat tie-downs including: "a plastic hinge at the seat-to-floor track attach point . . . which will deform without failure up to a certain point as the floor is displaced . . .;" "a ball and socket joint at the seat-to-floor track attachment . . .;" and "small aluminum collars on the seat track tie-down bolts between the nut and the floor . . . [which] . . . spread the load."[17]

---

[13] Cabin Safety: "SAFER Committee" Update (Aircraft Passenger Seat Design): Hearings Before the Subcommittee on Oversight and Review of the House Committee on Public Works and Transportation, 96th Cong., 2d Sess. 391 (1980).

[14] *Id.* at 683.

[15] *Id.* at 389.

[16] *Id.* at 684

The FAA staff further argued at these hearings that making seats stronger would make the seats more rigid, thereby transferring greater loads to the passenger and causing more injury.[18] However, after it was pointed in the Congressional follow-up letter that a seat can be strong without being rigid, Bond subsequently conceded that "impact resistance and energy absorption can both be designed into seats" and that "strength and rigidity are two different engineering concepts."[19] Amazingly, history is repeating itself and the current head of the FAA testified a few weeks ago that the agency could not increase seat strength because they'd make the seats more rigid.

Are there any valid reasons not to increase the seat strength standards today?

We do not believe that more research is needed before standards for stronger, dynamically tested seats can be written by the FAA. While research is always useful, the FAA should not reinvent the wheel or use research to ward off regulatory change.

FAA, military, and industry research in the 1960's, including the crash-testing of a Lockheed Constellation and a DC-7, showed that strong, dynamically tested seats are necessary and feasible. Instead of using this data, which has been refined from actual experience over the ensuing decade, the FAA feels that crash testing is needed once again.

---

[17] NTSB 1981 Cabin Safety Study, supra, n. 4 at 26,27.

[18] 1980 Cabin Safety hearings, supra, n.13 p. 391.

[19] Id. at 685

According to the NTSB, the FAA wants new data because it feels that the crash testing on the Constellation and DC-7 is outdated and does not represent today's actual crash environment. And yet, the Board points out, the FAA plans to do its crash test in 1985 on a B-720, a narrow-body aircraft with four wing mounted engines that resembles a B-707 and was certified only seven years after the DC-7. We share the Board's skepticism that such a crash test really will provide the FAA with data it will find more acceptable.[20] And we share the Board's concern that if we wait for the FAA to finish its research, we may not see better seats in aircraft until the year 2000.[21]

Since the FAA appears intent on doing the research prior to any rulemaking, we urge the Committee to at least make sure the FAA keeps its research program on schedule. The FAA denied our petition for stronger seats in January 1980, on the grounds that further research was needed, and issued a report in June 1980, outlining its schedule for research, including: integration of a three dimensional computer program which simulates the response of seat, occupant, and restraint system to a crash environment (SOMLA) with a mathematical model for crash simulation of aircraft structures (DYCAST) by FY-1981; performance of full-scale verification tests and documentation of this integration by FY-1981; utilization of the results of this verification to design, construct, and test new crashworthy seats by FY-1984; and to establish new design standards, test criteria, and procedures for crashworthy seats by FY-1984.[22] If these schedules have changed, we urge the Committee to find out why.

---

[20] NTSB 1981 Cabin Safety Study, supra, n. 4 at 30.

[21] Id. at 30.

It is interesting that in this area, as in the area of fire-blocking layers, the FAA is going to design the ideal light-weight product for the airlines before it suddenly becomes possible to write standards for improved seats.

In addition, we support the National Transportation Safety Board's call for interim standards in this area. In its 1981 report the NTSB recommended that the FAA:

> Establish and specify in the appropriate subpart of 14 CFR 25, interim standards for the design of seat and restraint systems and cabin furnishings to withstand the multiaxis acceleration levels such as those described by Simula Inc. in its Paper TI-8017. (A-81-141)
>
> Establish and specify in the appropriate subpart of 14 CFR 25 and in the related Technical Standard Orders, interim standards for static and dynamic testing of seat/restraint systems, including consideration of warpage or buckling of the attaching structure, and multiaxis dynamic pulses such as those described by Simula Inc. in its Paper TI-8017 and in the Aircraft Crash Survival Design Guide. (A-81-142)

As you can see, these proposed interim standards were developed by the Simula Company, which prepares the Aircraft Crash Survival Design Guide for the U.S. Army. The proposed interim standards were prepared in consultation with, and have the approval of, Mr. Joseph Haley who has played a key role in researching and upgrading crashworthiness for the Army. We think that the distinguished support of Mr. Haley, Simula, and the National Transportation Safety Board for interim standards (which have already been prepared for the FAA by Simula) is being tragically ignored by the FAA.

---

[22] Federal Aviation Administration Technical Center, Report No. FAA-Ed-18-6, "Engineering and Development Program Plan, Aircraft Crashworthiness," at 18, 19 (June, 1980).

CRASHES INTO WATER

The crash of an Air Florida B-737 into the Potomac River on January 13, 1982, and a May 5, 1983 Eastern Airlines L-1011 incident near Miami involving the loss of all three engines have raised again the question of how prepared we are for a crash into water. The answer is that we are very poorly prepared.

Unless an aircraft is travelling 50 miles from land, it will probably be carrying only seat cushions as flotation devices. These cushions expose the user to hypothermia by barely keeping him out of the water, and the Coast Guard says that they should never be used by non-swimmers or children. To make matters worse, many of the cushions lose buoyancy after a short period of time. Whether in the seas, a bay, or a river near an airport, the seat cushion is not going to be of much help. And you are going to need help since most airports near water do not have water rescue plans or equipment.

The Air Line Pilots Association has urged placing life vests on all aircraft travelling to and from the over 200 airports in the United States with large bodies of water in the approach and departure path. This proposal was turned down by the Federal Aviation Administration primarily, we believe, on cost grounds. Although the Federal Aviation Act of 1958 indicates that the FAA should be concerning itself with the "highest possible degree of safety" and not with airline costs, the FAA prepared a cost/benefit analysis of the ALPA proposal prior to turning it down. The FAA analysis concluded that "at most .53 lives per year could be saved by equipping air carriers with extended over-water survival gear. The statistical valuation of this benefit is $283,000 per year . . . The potential benefits are miniscule when compared to the costs associated with equipping the remaining air carrier turbo jet fleet with life vests . . . . . "[23] (estimated in the FAA analysis at $10 million dollars for initial procurement and $12.5 million dollars annually for maintenance and fuel costs based on data provided by the airlines).

There are two types of responses that can be given to this analysis. First, you can argue that the FAA's statistics are wrong, and that the potential benefits of having life vests are much greater than the .53 lives a year which the FAA has come up with. In other words, you could take the FAA's approach that safety improvements are only justified if they will pay for themselves in terms of lives saved and try to show that life vests will pay for themselves. The other route you can take is to note that there is a known hazard, the possibility of a crash into water, and a known solution, a life vest. The known solution should be applied to the hazard not because it is economical in some cost/benefit sense, but because the Federal Aviation Act requires the "highest possible degree of safety." We believe that the latter approach is the appropriate one for this particular industry.

---

[23] Memorandum on "Cost Assessment of Equipping Air Carrier Fleet with Water Survival Gear," from William R. Fromme, Acting Director, Office of Aviation Safety, to Anthony J. Broderick, Deputy Associate Administrator for Aviation Standards.(March 4, 1982).

Even if you are lucky enough to have a life vest on board your plane today, you are going to have a great deal of trouble getting it out of the package and on in an emergency unless you familiarized yourself with the multi-step procedure as a pilot during World War II. The FAA has acknowledged this problem by requiring that vests manufactured after 1985 must be designed so that they can be put on in 15 seconds. The bad news is that the FAA will allow the airlines to use their current vests until they wear out (when does a life vest wear out?) in another transparent move to save the airlines money.

We believe that all aircraft should carry life vests, and that the life vests should be capable of being donned in 15 seconds under simulated emergency conditions. We see no reason to wait on this proposal until we have a whole plane load of people drown in a crash.

THE ROLE OF CONGRESSIONAL OVERSIGHT

What role does Congress play in seeing that the FAA is properly carrying out its mission of assuring the highest degree of safety for the travelling public? Ultimately, Congress must bear considerable responsibility for the FAA's performance or lack thereof. It is Congress which has given the FAA a broad mandate to regulate air safety, and it is Congress which must seek to ensure that the agency is doing the job Congress laid out for it.

You, Mr. Chairman, have spoken eloquently and often about the need for vigorous Congressional oversight of the activities of regulatory agencies, and the FAA's performance in this area merits consistent and ongoing review. There is a real problem when, as here, agencies embark on research and rulemaking projects which can involve years of work. As you know, FAA administrators come and go, priorities tend to shift over time, and with chronic budgetary pressures, today's number one priority can be put on the back burner in the next year's budget -- or until there is another major accident where the same problems are tragically demonstrated. Sadly, this has been the history in the FAA's decade-long efforts in such areas as airborne collision-avoidance systems, fire safety, aircraft de-icing, wind shear detection, and seat strength.

What is needed is for Congress to review the FAA's proposed regulatory activities on a regular basis, preferably in annual oversight hearings of the sort this Subcommittee initiated in this area in 1979 and which you are continuing today. We applaud your efforts to find out from the FAA "how much is it going to cost, and how long is it going to take? What are your deadlines for final action on this particular problem? What interim steps are you planning, if some final solution is not technically possible for some time to come?"

If this Subcommittee comes back each year and asks the same questions, deadlines cannot be ignored and problems cannot drag on for years without a solution.

Once again, we think this Subcommittee's efforts to monitor the FAA's performance in cabin safety is having a very beneficial effect for passengers and we thank you for those efforts.

Mr. LEVITAS. Thank you very much, Mr. Finucane. Your observations are obviously very pertinent to what we are talking about.

On page 11 of your prepared statement you discuss fire hardened windows and suggest additional development of these windows is needed. Dr. Parker, whose work you make reference to, was a witness before this subcommittee in 1979 and discussed this window in great detail. As I recall, the window was ready at that time and may already be programmed into new versions of existing aircraft, such as the DC-9-80.

What additional developments do you think might be warranted?

Mr. FINUCANE. I was relying on Dr. Parker's analysis that this particular window that he was referring to still needed some research into the effects of changes in cabin pressure and temperature. I would agree with Dr. Parker that you can move ahead with rulemaking now because even if there is a year or so more of research to do, once you have issued the NPRM, it is all going to be completed, and completed in a hurry.

I would agree with Dr. Parker, then, that that is something that ought to be done now. And I believe that the NTSB's testimony was also that that is something that the FAA should move forward on very quickly.

Mr. LEVITAS. In your statement, you also make reference to the seat blocking layers, and indicate that you saw this at FAA headquarters in June 1982. Did you happen to be present in 1979 when this subcommittee heard from Mr. Duskin from Douglas Aircraft, and he presented a video tape on their seats?

Mr. FINUCANE. I was not here. I read that testimony and know that it showed the dramatic improvements that those seat-blocking layers would have brought about in terms of cutting down on the toxic gas and smoke emissions. The charts they submitted were just incredible.

And, again, you could go back that far and say that at that time the FAA should have moved forward with this.

Mr. LEVITAS. Do you have any explanation of why it took FAA so long to announce the improvement they did?

Mr. FINUCANE. I do think it was cost. Cost and cost again. I think that is the reason you are not seeing a lot of these improvements, whether it is fire-blocking layers or life vests. The FAA's concern is with what is the additional weight of the fire-blocking layer? Their original estimate was, that Vonar, was going to add 2 or 3 pounds per seat. Strangely enough, even though they allow passengers to bring on just about anything onto the plane, no matter how much it weighs, they feel that 2 or 3 pounds per seat was too much of a cost.

So I think the cost concern is fairly clear. In fact, they are so concerned about cost that they have actually developed a computer model up at the Tech Center to assist the airlines in calculating the costs of installing the different kinds of seat liners. That model is one of the projects that they have completed and that they are working on putting data into.

They basically perfect the produce for the airlines. They act as management consultants for them. It is not what you normally think of as a true regulatory approach to this kind of thing. They are kind of spoon-feeding products to the airlines. I think that is one of the holdups in the seat strength area, too.

If you look at what they are saying publicly, it is that it is too complicated for us to set seat strength standards because we aren't sure what the forces really are in a crash. But when you look at their research proposals, what they are doing simultaneously with developing the seat standard is developing a light-weight seat for the airlines.

So once they develop this light-weight seat which wouldn't impose costs on the airlines, then all of a sudden it is kind of miraculously going to be possible to set standards. I think you can also see this process in the overall standards for smoke and toxicity throughought the cabin.

Do you know at NASA now they are developing graphite paneling which is going to provide a 20-percent weight reduction in the paneling system if it works. And maybe once you get the lightweight panels, the FAA will all of a sudden say, well, maybe it is possible to set standards for the panels. So I think cost is the problem here.

Mr. **Levitas**. Yes; that is a situation, a concept, that warrants a lot of reflection by everybody concerned because if all you are looking at is cost-benefit based upon statistical experience up to a certain point, one might be abie to make the case that it is less expensive for the airlines to do nothing. And every 15 or 20 years they could pay off the excess cost over the insurance of the consequences of an accident, if you are just talking about the economic cost-benefit.

Mr. **Finucane**. I don't think that when Congress passed the Federal Aviation Act, and said we want the highest possible degree of safety, that they were saying we want the degree of safety you get when you do a cost-benefit analysis.

Mr. **Levitas**. Well that is true. But, of course, when Congress passed that legislation, we also said that FAA should take into account the economic well-being of the air carriers.

Mr. **Finucane**. I know Langhorne Bond said the only thing he did in that regard was go to the Paris Air Show.

Mr. **Levitas**. I remember that.

Mr. **Finucane**. He really didn't consider that to be an overriding concern.

If you look at the cost-benefit analysis that was done in the life vest area, what they are really saying is that you can only have life vests if they pay for themselves in terms of lives saved. Now even if that were the approach you were going to take, it would be very difficult to do that kind of analysis in this area where there are so few accidents.

Mr. **Levitas**. Yes; were you the representative of ACAP on the SAFER Committee?

Mr. **Finucane**. No; I was not. I was not the one who attended those.

Mr. **Levitas**. Do ACAP records indicate some dissatisfaction with the failure of the SAFER Committee report to include what seemed to be some worthy recommendations?

Mr. **Finucane**. Yes; there were many recommendations made at the subcommittee levels that didn't make it out of the committee. I think, for example, they were very carefully considering perhaps recommending an interim smoke standard, and perhaps a movement from the Bunsen burner test to the radiant panel test.

One of the premises, of course, of the SAFER Committee was that, and they probably considered this in disregarding those interim solutions, they expected the FAA to be coming up with their combined standard in just a couple years. So once again, you would want to reevaluate this matter. If it looks like the FAA is not going to be able to come up with a combined hazard index, it might be a good idea to go to some interim solutions, for example, with a radiant panel test, or with some kind of test for smoke emissions. Certainly there hasn't been much progress, nor was there much additional research needed, in the area of smoke, even if there was more needed in the area of toxic gas.

Mr. LEVITAS. Mr. Molinari.

Mr. MOLINARI. Just one line of questioning here, Mr. Chairman. That is interesting, on page 8 you are advocating total elimination of smoking on the plane, which leads me to ask you the question, Are you a smoker, yourself?

Mr. FINUCANE. No; I am not a smoker. Of all the recommendations in this, I think this is the one that would be most unpopular with many members of the traveling public. Of course, you do have the problem of the paradoxical effect that if you eliminate it, you may end up with more people smoking in the lavatories.

Mr. MOLINARI. That is precisely why I asked the question. I was going to lead up to that. The other witnesses who, when asked about whether they would advocate a smoking ban, ones that work in the planes themselves indicated the net effect would be more smoking in lavatories and probably more lavatory fires.

Mr. FINUCANE. I certainly would not want to see a ban on smoking unless they developed an adequate way of detecting smoke in the lavatories.

Mr. MOLINARI. That would seem to be a more commonsense approach.

Mr. FINUCANE. Yes; also over a period of time, you might find people became educated to the fact that they weren't going to be allowed to smoke. It is also possible to have civil penalties for people who break Federal Aviation regulations.

Mr. MOLINARI. Let me ask you this question: It seems to me if you are going to ban smoking, you have to have an absolute guarantee that there is a way to prevent smoking in the lavatory. But I am not a smoker, myself. There was a time when I was a cigar smoker. But I do know that those who smoke cigarettes and smoke several packs a day have a very difficult time, because it is an addiction.

If we are talking about an international flight where you might be on a plane for 6 or 8 hours, how do you cope with the addiction problem of a smoker that is a heavy smoker?

Mr. FINUCANE. Again, it would be an enforcement problem. If you assume that the addicted person was going to try and thwart what you were trying to impose, you would have to then put in the lavatory area all the other safety improvements that have been suggested——

Mr. MOLINARI. I have heard some people indicate that if they were deprived of a cigarette for more than an hour or so that they would be ready to jump out of an airplane. I can recall debates in the state legislature where heavy smokers made that same indication. I am just wondering whether there wouldn't be, talking about the flight attendants and the myriad problems that they have today, that if they had to deal with this problem on a long flight, TWA flights, for example, intercontinental, what additional problems they might inherit as a result of an outright ban?

Mr. FINUCANE. I think there would be problems with those people. But what you have to do is weigh that against the current situation of people thinking that the plane is a place to smoke, that the whole airplane is a place where they can smoke freely, and that they can smoke in the bathrooms. You have to weight against a general population smoking in a highly flammable environment around materials that give off thick clouds of smoke and gas, and from which there is no egress.

So your choice is either having a lot of people smoking and some of them in the bathroom, or having, if you ban it, perhaps a few addicted people doing it——

Mr. MOLINARI. I am just wondering, I can see, for example, a ban on shuttle flights, I am from New York. An hour flight isn't going to kill anybody.

Mr. FINUCANE. I would like to look into that some more and perhaps respond.

[The following was received from Mr. Finucane:]

[Supplemental material from the Aviation Consumer Action Project]

Dow Chemical is currently seeking FDA approval of a nicotine-containing chewing gum for use by persons dependent upon nicotine. Persons so dependent might also use the FAA exemption process to circumvent a smoking ban.

Mr. MOLINARI. It would seem to me, and I would close the questioning at this point, that there might be some merit to banning smoking on the short flights. Perhaps there might be a more controlled atmosphere where, if possible, and I think almost anything along these lines is possible, you might have a controlled environment, perhaps in a lavatory, where you ban smoking today if you could have it fire proofed entirely, where those who are heavily addicted might be forced to smoke only in a lavatory or some such thing.

Mr. FINUCANE. I should mention NASA has in its testing has constructed a completely fireproof lavatory.

Mr. MOLINARI. There you go. Thank you very much.

Mr. LEVITAS. Thank you, Mr. Finucane. I will just say this in response to some opening comments you made. As far as this subcommittee is concerned, it is going to take more than burning another airplane up in New Jersey or making the announcement of some improvement for the first time in 20 years to deter us from seeing that there is some action taken. We intend to be very vigorous and very persistent and to do so in a relatively short timeframe to get some major and significant new improvements in cabin safety, whether it is done by the FAA or whether it is legislated by Congress.

Mr. **Finucane**. I think this committee's continued oversight in this area is having and will have tremendous benefits for the passengers in the cabin safety area, and I want to thank you for that continued effort.

Mr. **Levitas**. Thank you, Mr. Finucane.

In closing these hearings today, I wish that I had used a term other than "disappointing" to describe the FAA's regulation of air safety. Perhaps the word "disgraceful" would be more appropriate. And I have no intention of ignoring the complacent attitude, both of airframe manufacturers and of air carriers. Some good share of the failure of the FAA to have promulgated more stringent standards lies with the persuasive arguments of these industries on the economic factors.

Unfortunately, the victims of their inaction cannot be there to share with us their last few moments in this environment.

In the weeks ahead we will have our staff probing deeply into the additional subject of cabin safety. We will be discussing the newer and now available materials which are far superior to anything presently installed in aircraft and which should be required as replacement materials when refurbishing takes place.

We are aware this will take time, and so we will also be looking at presently available fire suppression and detection systems. And I, for one, believe there are many interim measures that can be taken, including human factors and evacuation procedures, training improvement, emergency breathing devices and the like, that would go very far to reducing unnecessary deaths in aviation accidents where there is smoke and fire in the cabin.

While the flight attendants may sometimes be able to detect smoking in lavatories, some of the innovative devices which we will present in public hearings will do it much quicker, to the embarrassment of the smoker and in a manner which will provide a permanent record of the incident on the flight voice recorder.

While we do not want to sell any particular products, we believe it is important to demonstrate in public hearings the quality of what is available and that if their use was required, the economic argument would soon disappear.

I suspect these hearings could resume even before we return from the August-September recess. If the subcommittee is not once again diverted by some unexpected emergency situation, we hope to begin our second round of hearings as quickly as possible.

And, as I say, even with chance, it could be before we return from the August-September recess. If that schedule can be adhered to, then I believe we can complete the hearing sometime in September or early October and suggest some recommendations to FAA to improve their management of our safety.

Obviously, we will be hearing from the administrator of FAA before these hearings are completed, and the decision whether to have FAA respond to these concerns, or whether legislation should be introduced to do so I am sure can be made at or shortly after that testimony.

I want to thank the witnesses who appeared here today and also those who appeared during the last 2 days. Your testimony is going to be invaluable as we continue to compile a record upon which we will require the FAA to give an accounting of their stewardship.

Mr. Molinari, if you have a closing statement.

Mr. **Molinari**. I just would like to join in with what you have said, Mr. Chairman. And if any industry people are out there, or perhaps read the transcript of the testimony, certainly I think that it shouldn't come to the point where Congress has to legislate improvements in aircraft safety.

But it seems to me, as a relatively new member to this body and reading the testimony of past subcommittees over the years, that there has been a great deal of repetition. That puts us in a position where we can no longer sit tight and wait on the promises of others.

Some of the witnesses have pointed out, we have administrations come and go, and new people come in and they have new ideas. The net result seems to be a lack of action. I think those who produce aircraft and sell them, and that is their source of income, or those who carry passengers would listen carefully. Because it would seem to me from their standpoint, it would be far better for them to affirmatively take a responsible position than to have us, members of Congress, force them to do so by virtue of legislation.

Thank you, Mr. Chairman.

Mr. **Levitas**. Thank you, Mr. Molinari.

If there is no further business to come before the subcommittee, the subcommittee stands in recess subject to the call of the Chair.

[Whereupon, at 6:30 p.m., the subcommittee was recessed subject to the call of the Chair.]

[The following documents were subsequently received for the record:]

STATEMENT OF
Lisa Yates, Director, Health and Safety
INDEPENDENT UNION OF FLIGHT ATTENDANTS

regarding

Aircraft Cabin Emergency Preparedness

Good morning, and thank you for the opportunity to appear before your committee. My name is Lisa Yates, and I am speaking on behalf of 7,000 flight attendants, the second largest flight attendant union in the United States, the Independent Union of Flight Attendants. My position is that of Director of Health and Safety for IUFA.

I am here to speak primarily on Aircraft Cabin Emergency Preparedness and the appalling lack of standardization in types and locations of emergency equipment, not only as placed aboard differing aircraft models, but even within the same aircraft type. I am here to speak on how easily Federal Aviation Regulations can be watered down from their original intent of providing maximum safety levels to aircraft cabin occupants for the convenience of maintaining air carrier schedules. And, I am here to speak on how we, the flight attendants, who are entrusted with passenger safety in the aircraft cabins, are so frequently hampered in the performance of safety related duties due to service requirements.

No one would dispute the fact that COMMUNICATION is vital in dealing with an emergency. An FAR (Federal Aviation Regulation) was written with just that principle in mind:

FAR 121.318 PUBLIC ADDRESS SYSTEM, which states in part: (a) no person may operate an airplane with a seating capacity of more than 19 passengers unless the airplane is equipped with a public address system (1) that is capable of operation independent of the crewmember interphone system...(b) The public address system required by paragraph (a) of this section must...meet the following requirements:

(1) It must be accessible for immediate use from each of two flight crewmember stations in the pilot compartment;

(2) It must be accessible for use from at least one normal flight attendant station in the passenger compartment;

(3) It must be capable of operation within ten seconds by a flight attendant at those stations in the passenger compartment from which its use is accessible; and

(4) Transmission must be audible at each passenger and flight attendant seat and in each lavatory.

Air carriers, in their Aircraft Operating Manuals, publish MEL's (Minimum Equipment Lists) which allow variations to FAR's based on certain situations. For example, MEL 214.010, under Requirements For Flight, states: PUBLIC ADDRESS SYSTEM - Passenger Airplane: May be inop provided the cabin interphone system is fully operative between the flightdeck and cabin, including the interphone call lights and chimes. The MEL goes on to say: Cabin attendants must be briefed that the PA is inop and that extra vigilance must be maintained for cabin interphone calls. Flightdeck and cabin announcements can be relayed verbally or, in case of emergency, by using the megaphone.

Failure to have a fully functional PA can result in several serious compromises to our crew and passengers. In a recent evacuation of a jumbo aircraft, the lack of a PA announcement from the flightdeck resulted in three different responses from within the cabin. The accident was completely survivable, fire was present, but no two crewmembers in the cabin reacted the same way. Some used emergency chutes, some simply waited and allowed their passengers to collect personal belongings and walk forward to normal exit doors, and some told their passengers to remain seated to await an announcement from the flightdeck. Passengers, in interviews following this "evacuation" expressed surprise. That it appeared three different airplanes were being evacuated.

In the event that cockpit crew members are incapacitated, flight attendants who are able to see the imminence of a fuel fire, not visible to other flight attendants, should have the capability of having a functional PA system to say "Evacuate the aircraft immediately." Ensuing confusion would be greatly minimized.

The FAA, in allowing this particular MEL to be published, is causing the violation of another FAR, namely: In the event of an emergency landing, planned or unplanned, pilots are required to give two warnings, one at 500 feet above the point of water/land contact - stating "Flight attendants be seated." This is our warning to take our own assigned seats. At the 50 feet above contact level, FAR's require the statement to all cabin occupants to "Brace for Impact." Crash will now occur within seconds. This command in no circumstance can be transmitted to our passengers without a fully functional PA. How can the pilots relay that command?

In a similar fashion, another FAR on functional interphones required on board passenger aircraft is also weakened through the use of an MEL. Specifically: MEL 214.010, Cabin Interphone System - May be inop provided the public address system (PA) is operative. It goes on to say - Flightdeck crewmembers must monitor PA throughout the flight. And, Cabin attendants must be briefed to bring routine messages to the flightdeck personally.

One of our own aircraft was hijacked recently, with an inoperative interphone. We had no way of communicating that our aircraft was being commandeered by two hijackers, except to open the cockpit door and relay this personally. Under no circumstance should we ever expose our pilots to hijackers with weapons: that cockpit door provides the only barrier at 35,000 feet.

Inoperative PA systems are not our only problem. One or both of our "required" megaphones in the cabin may also be inoperative, with no requirement that the PA be functional in that event. Our Emergency Training Department has advised flight attendants to "Shout", but I seriously question, when impact might be imminent, or there is inadequate time to prepare the cabin for an emergency landing, that all passengers can hear shouted commands emanating from various parts of the aircraft, particularly our wide-bodied aircraft seating in excess of 400 passengers.

National Transportation Safety Board studies have shown that megaphones have rarely been used during evacuations. A reason cited by the NTSB has been that the flight attendants were not able to remove these units from their retaining wall-or-compartment brackets. In other cases, where substantial smoke was present, flight attendants were physically unable to walk to the megaphone due to the fact that megaphones are located in overhead compartments or hatracks within the cabin; this requires that the flight attendants walk against the flow of passengers attempting to get to front or rear exits. Additionally, these megaphones are located near the ceiling, the area of densest smoke. So, it is not only physically impossible to walk to these locations, but choking smoke also would disallow removing of this unit from brackets. We are told repeatedly to "stay low, close to the floor" when smoke is present, yet these megaphones are mounted high. No wonder they are hardly ever used as life saving devices to help direct passengers to open exit doors!

Present FAR's make no specific requirements regarding location except to say, "Two megaphones in the passenger cabin...one installed at the forward end and the other at the most rearward location where it would be readily accessible to a normal flight attendant seat." (FAR 121.309 (f)).

Our union has asked repeatedly that megaphones be located at flight attendant jumpseat locations, forward and aft, and we have met with no success in initiating a change.

Emergency lighting, again, is placed high in the cabin, where smoke would be densest. Our union strongly recommends armrest level or floor level lighting to assist confused passengers in finding floor-level and window emergency exits. Additionally, MEL's again state, in 214.010 (33-3): Normal [illegible] lights may be inoperative (lights controlled by EXIT LIGHTS pushbutton.) So we do not even have the assurance that emergency lights will be operational.

Time and again, our union sees FAR's reduced in force or intention by the use of the MEL procedure. This procedure appears to be intended to help the air carriers accomplish on-time departures. We would like to see the line drawn more toward the interests of safety than to convenience on the above issues.

Our flight attendants are experiencing particular difficulty regarding location and type of hand fire extinguishers in our cabin compartments. It is standard for all of our aircraft to have one CO_2 and one Smoke Combat Unit in the cockpit. In some cases this CO_2 is now being changed to a Halon-type.

The situation in our cabins however is almost comical. Within the 727 series of Boeing aircraft, we are flying ten configurations on that type aircraft alone. We also fly five configurations of aircraft in the Boeing 737 series. Then, the 747-100, the 747-200, the 747SP, the DC-10-10 and DC-10-30, and the L-1011. Within the above mentioned wide-body aircraft, we can again have differing configurations depending on whether it is flying in a high density charter configuration or normal first class/cabin class. The difficulties which we face are nonstandardization in locations of fire fighting equipment. In airplanes that would appear similar, a given fire extinguisher can be in any of several locations.

In some aircraft, only H_2O extinguishers were present in our cabins: little help in flammable fluid fires. The only existing CO_2 bottle, being in the cockpit, again is not recommended in the event fire results from a hijack situation. (This, I believe, is being rectified due to our recent experience.)

The point that becomes obvious, is that FAR's once again, are not specific in mentioning types or locations of fire extinguishing equipment required aboard our various aircraft types. The FAR covering FIRE EXTINGUISHERS FOR CREW, PASSENGER, AND CARGO COMPARTMENTS, 121.285 Subpart K 121.309 (c): Hand fire extinguishers of an approved type must be provided for use in crew, passenger, and cargo compartments in accordance with the following - (1) The type and quantity of extinguishing agent must be suitable for the kinds of fires likely to occur in the compartment where the extinguisher is intended to be used.

I can assure you that "the type and quantity" of fire extinguishers on board aircraft can vary greatly, and even within the same series of aircraft within the same airline company. I believe that the travelling public has the right to expect a certain safety standard below which air carriers will not be allowed to operate over U. S. soil. We, the flight attendants, NEED the fire fighting capability which we feel is lacking on so many of our aircraft.

Lavatory fires are of particular concern to us, due to the fact that it is not possible for us to monitor lavs on a regular basis due to staffing/service requirements. Usage of meal and bar or beverage carts precludes the possibility of a single flight attendant from being able to "make the rounds" during meal services; and following meal services, long-lines are well-documented for gaining access to same. It is not always possible to smell the telltale odor of cigarette or other substance-smoke emanating from a particular lav and I have personally experienced all too often the fact that I have entered a lav only AFTER a smoking passenger has exited.

My ability to react, therefore, to a passenger smoking in a lav is greatly minimized. Fire detection or smoke-detection is absolutely essential here.

Additionally, the area of emergency flight attendant training has been brought up. Our union is fortunate in that our airline has chosen to utilize all 12 training hours required by FAR's in yearly training. Our company has not asked for an exemption, perhaps because of the multiplicity of aircraft and many letters of concern that were directed to our company and to the FAA as well. However, even in that 12 hours per year time-frame, we do not have adequate hands on training, in the opinion of our union. Our training is divided into four phases, one phase every six-months, with a complete cycle concluding every 24 months. We are experiencing "Hands On" only once every two years, for example, in the use of fire extinguishers. Halon is not being discharged in our training, we only pass around the bottle and comment on how light-weight it is.

Fire extinguishers, in our opinion, should include Halon for the cabins of all aircraft. Our flight attendants should not have to assess the source of a lav fire, whether it is paper or electrical in origin: we should be able to go in with a Halon AND a Protective Respiratory Device for ANY lavatory fire to get to the source. Shooting blindly is not adequate as a response, in our opinion. The current FAA approved method of placing H_2O bottles near lavatory locations should end. The chance for electrocution is high, since as we have discovered crew members cannot be sure of the CAUSE. We had occasion, in one lav fire aboard one of our aircraft, to discover that a passenger disharged a water extinguisher into the lav after he noticed smoke. He was lucky. He acted before flight attendants could and thought he was helping out. We must not forget that possibility: flight attendants do leave areas of the aircraft, including lavs, unattended for long periods of time.

Last, in discussing our ability to check and monitor the cabin for hazards in-flight: we are required to do ground checks of emergency equipment before departure. Our flight attendants totally support this improved checklist, however, again because of scheduling and on-time departure constraints, we find that all too often we are trying to check our equipment during passenger boarding, and any attempt at asking for a delay in boarding is met with great resistance. It is not unusual, in our crew patterning, for a flight attendant to board three different aircraft in the course of one working day, and be unable to check for functioning and location of emergency equipment because of this "On Time" pressure. Flight attendants have, on occasion, been told that they will personally be charged for any possible ensuing delay to the flight.

In summary, our flight attendants like to see themselves regarded as the safety professionals that they, in fact, are. Safety, and the ability to evacuate an aircraft in 90 seconds, is the primary reason for our presence upon U. S. Carriers. We would like to see that the FAA and ATA do not lose sight of that fact whenever Industry-wide safety briefings are planned. For the record, flight attendants were excluded earlier this month from just such a planned briefing regarding aircraft and airport security, and would like to be assured that such an exclusion of flight attendant safety representatives does not occur deliberately again. We are, after all, the front line of defense in any aircraft emergency. We would like to request all the support necessary to get our job done, for maximum survival capabilities of all on board.

Thank you once again for your invitation to participate. This concludes IUFA's testimony.

Aerospace Industries Association of America, Inc.

July 18, 1983

Mr. John P. O'Hara
Counsel and Staff Director
Subcommittee on Investigations and Oversight
Committee on Public Works and Transportation
U. S. House of Representatives
B-376 Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. O'Hara:

Pursuant to your telephone conversation with Susan Walsh of our Legislative Affairs Office, I am enclosing a paper prepared by AIA's Transport Airworthiness Requirements Committee regarding aircraft cabin fire safety design and standards. I am also including a copy of a statement submitted by AIA to the Science and Technology Transportation, Aviation and Materials Subcommittee, which recently held hearings on aircraft maintenance and fire safety issues.

Please feel free to contact me if I can be of further assistance to you.

Very truly yours,

AEROSPACE TECHNICAL COUNCIL

J. P. Reese
Director
Airworthiness Programs

Enclosures

1725 DeSales Street, N.W Washington, D.C. 20036 • (202)429-4600

July 15, 1983

AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC.
POSITION ON AIRPLANE CABIN FIRE SAFETY DESIGN

The Special Aviation Fire and Explosion Reduction (SAFER) Advisory Committee spent nearly 13 months from May 1979 through June 1980 examining the factors affecting the ability of the aircraft cabin occupant to survive in the post-crash fire environment. Although in-flight cabin fire was not the object of the SAFER Committee study, it was considered during the review of accidents which formed the foundation for the ensuing technical studies. The SAFER Committee reviewed the National Transportation Safety Board (NTSB) reports of accidents involving transport category turbine powered airplanes in the U.S. air carrier fleet for the 1965-1979 period. The SAFER Committee's final report concluded: ".... the safety record of the scheduled airlines is excellent when compared to other transportation modes ..... While year-to-year variations occur, the average rate of approximately 32 fire deaths per year has been fairly constant despite the great increase in air travel during this period."

The excellent fire safety record of commercial aircraft can be attributed to all those involved, including the manufacturers, the operators and the Federal Aviation Administration (FAA). We believe that the circumstances of any aircraft fire should be studied, and appropriate countermeasures taken, where indicated. The airplane manufacturers are dedicated to maintaining and, if possible, improving the high safety standards evident from past records. In supporting cabin fireworthiness design, AIA would like to point out those steps taken since 1965 to improve airplane fire safety design and propose the most beneficial steps to continue this program.

ADVANCES IN FIRE SAFETY

Proponents of "improved" airplane fire safety often equate progress with vigorous regulatory action. Consequently, in situations where industry developments and designs are not quickly embodied in mandatory standards, it has been erroneously assumed that a lack of FAA concern is to be blamed. Regulatory action in and of itself does not "develop" safer airplanes. Mutual recognition by government agencies and industry of an area of concern has led many times to viable solutions which were incorporated, and sometimes defined, in the airworthiness standards. Both industry and the FAA recognize that poorly developed and/or premature regulatory actions will promote ineffective, poorly directed and highly politicized use of industry and government resources while accomplishing minimum progress in the area of fire safety.

The following is a review of some of the past advances in cabin fire safety:

o AIA Activities Preceding Amendments -15 and -32 to FAR 25

In the early 1960's, airplane manufacturers selected materials which exceeded the currently required horizontal Bunsen burner test requirements and began developing them for airplane interiors. In

1967 and 1968, AIA supported the FAA with a Crashworthiness Development Program (CDP). From this cooperative effort new flammability standards were established for current airplanes, and widebody airplanes were designed according to even more stringent requirements defined in special conditions issued by the FAA. These special conditions were incorporated in the FAA Aviation Regulations in 1972.

o AIA Activities Supporting Use of Low Smoke/Toxicity Materials

In addition, airplane manufacturers recognized the importance of using materials with low-smoking characteristics whenever possible. Since the advent of the widebody transports, the manufacturers have ceased using some materials altogether because of their greater smoke producing characteristics, and have selected or developed low-smoking materials for other applications. Smoke test data were voluntarily given the FAA for review.

o AIA Participation in the FIREMEN Program

In the 1970's, NASA sponsored a FIREMEN (Fire Resistance Materials Engineering) program which funded basic research in airplane interior materials and which encouraged industry funded R&D projects in materials development. From these programs materials were developed with improved fire resistance, and have since been incorporated in commercial airplanes. FAA, NASA and industry sponsored research has provided new methods for flammability evaluation and where possible, these methods have been applied for further upgrading of new airplane interiors. Laboratory tests and large scale tests are conducted to determine heat release rates, thermal decomposition temperatures, smoke and toxic gas emissions, oxygen index values and fire containment capabilities.

- AIA Participation in the SAFER Advisory Committee

In 1980, the SAFER Advisory Committee issued two principal recommendations for material development: (1) fire resistant seat cushions and (2) radiant heat resistant evacuation slides. The airplane manufacturers, materials suppliers, the FAA and NASA cooperated under several programs to develop concepts for both these applications. Without new regulations, many new slides have incorporated the desirable heat resistance. It has been determined that some existing slides do in fact already meet the desirable heat resistance. AIA has released a recommendation for feasible and practical seat cushion fire-blocking. Suppliers, airlines and seat manufacturers have begun implementation.

The SAFER Committee also concluded that "Toxicity test standards do not exist for aircraft fire situations. Further, there is no agreement among specialists on the approximate magnitude (statistical) of the toxic contribution from burning interior materials relative to the contribution from burning turbine fuel or other fire related hazards."

In an effort to reduce toxic gas emissions, aircraft designers have been reducing the quantity of organic materials within the cabin and avoiding organic materials which produce excessive amounts of any noxious fumes.

- Changes Incorporated Without Regulatory Requirement

Other changes have been made to enhance passenger protection and survival in cabin fires. Among these are improved lighting and evacuation system standards which were evaluated and proposed in cooperation with the FAA during the AIA Crashworthiness Development Program in the 1960's. More recently, tightly sealed lavatory waste compartments were incorporated with release of an FAA Airworthiness Directive. In addition, airplane manufacturers voluntarily made available and/or installed thermally-actuated extinguishers in the waste compartments of their airplanes.

- AIA Transport Airworthiness Requirements Committee (TARC) Report on Seat Blocking Layers

The AIA TARC project group on seat blocking layers has completed its report. Early in this program, a survey that had been started to identify candidate materials or material combinations was continued. This survey resulted in the identification of Norfab, Celiux, 1.5-200, and PBI fabrics/felts as viable candidates. The project group carried out, with the FAA and NASA, a coordinated round-robin test series to help establish acceptable test procedures.

CURRENT AIA FIREWORTHINESS CONSIDERATIONS

Since completion of the SAFER Committee's reports, another AIA TARC project group was formed to address in-flight and post-crash fire threats. Specifically, this project group was charged with (1) establishing fire scenarios to be addressed, (2) determining ignition sources, combustibles and propagation methods to be considered, and (3) recommending to FAA and NASA large-scale tests required to establish needed data. The project group will present its findings in 1983.

The above review of progress in fireworthiness design emphasizes that the most effective progress occurs when Government agencies and industry cooperate in a coordinated and organized effort. An adversary environment of premature rules and enforced premature industry response will not promote effective development of fireworthiness designs with the available resources. Because AIA is concerned with the infrequent coordination between the many ongoing government agency and industry projects on fireworthiness, the AIA TARC project group will continue to work and coordinate with NASA, FAA and the Air Transport Association (ATA) to evaluate possible fireworthiness concepts and solutions for the defined scenarios and fire threats. In this fashion all concerned can concentrate on priority research to define adequate standards for regulatory purposes. Safety cannot be advanced by the writing of regulations beyond the capability of state-of-the-art technology. Timely advancements can be made incrementally if safety-conscious Government agencies and industry cooperatively share the research burden and results.

STATEMENT OF
AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC.
CONCERNING
THE FAA SERVICE DIFFICULTY REPORTING SYSTEM AND AIRCRAFT MAINTENANCE
BEFORE THE
SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

JULY 1, 1983

The Aerospace Industries Association of America, Inc. (AIA), the trade association representing the nation's major manufacturers of commercial and military aircraft, spacecraft, aircraft engines and related components and equipment, appreciates this opportunity to provide our comments on the FAA's Service Difficulty Reporting System and related aircraft maintenance matters.

The diversity of aviation products results in a number of different requirements and internal procedures for handling and processing operational data relative to service difficulties and maintenance information. However, all member companies that are involved with commercial aviation products maintain reporting procedures responsive to the Federal Aviation Regulations which are applicable to their products. In addition, the larger companies, such as engine and airframe manufacturers, maintain extensive data collection and analysis capability through customer service organizations and by utilizing a number of government and private data sources such as the NTSB, FAA Service Difficulty

Reports, Flight Safety Foundation publications, ICAO reports and several others. In some cases, in addition to written hard copy data, magnetic tapes are obtained directly for use in quick access computer systems within a company.

Although internal technical procedures vary with different companies, there is general agreement and consistency among companies regarding the gathering, internal use, and reporting of operational data relative to incidents and significant maintenance events.

From the manufacturer's point of view, information feedback from in-service operation is essential at all product levels. These are the data that provide the knowledge of the real world environments in which the product must function. Most of the product and safety improvements that have evolved over several generations of commercial transport and general aviation aircraft are due in large part to the extensive recovery and analysis of operational data. To the best of our knowledge, no other transportation industry has an equal or better capability. This is due largely to the past and present systems mandated by the Federal Aviation Regulations and maintained by the FAA, and to the cooperation and support of the many domestic and foreign customer operators of these aircraft.

Nevertheless, as with all endeavors, there are some problem areas where improvements could be effected. In our view, the FAA Aviation Safety Analysis System (ASAS) currently under development will provide significant improvements. Some specific improvements that could be made in the Service Difficulty Reporting System include:

1. Obtaining more complete reporting of the required item. The FAA currently receives approximately 23,000 SDRs (Service Difficulty Reports) each year. Because of this volume, individual reports are often quite brief and cryptic by the time they are provided to the industry on magnetic tape or in written summary form. This limits the manufacturer's ability to make a high confidence judgment on the seriousness of the event for followup analysis. From the manufacturer's viewpoint, increasing depth rather than breadth would make the system more useful and cost-effective.
2. Providing for uniformity in type of events reported. There is presently some inconsistency [illegible] operators as to the type of events most frequently reported. Some report mostly structural items, others primarily system anomalies, etc. We believe that rational guidelines can be developed without impacting existing regulations or creating [illegible] reporting burden on the operators.
3. Avoiding overreporting [illegible] following a newsworthy event. For a period [illegible] newsworthy incident, the SDR system tends to overreport with [illegible] minor items that have only a tenuous connection to the cause of the incident. This reaction overburdens the system temporarily and can cause more significant items to be overlooked or unreported.
4. Considering a requirement to report certain maintenance errors and improper usage. These data would be useful to manufacturers for assessing the quality of their recommended maintenance procedures, operating [illegible]

As a consequence of these problems--and to some extent, as a consequence of the NTSB and FAA data systems' inherent time lag between noting an event and providing the manufacturer with the relevant information--the primary source for rapid and comprehensive information on significant events is presently the manufacturer's customer service reporting system. This consists of TWX's, telephone conversations and service reports.

From a safety standpoint, the critical events are almost always reported through the airframe or engine manufacturer's customer service reporting system before the SDR or other external sources of information are available. We believe that the Aviation Safety Analysis System when fully implemented, will significantly reduce this time lag, and with properly trained, qualified personnel can ameliorate the problems discussed above.

A Customer Service Technical Representative is assigned to key airports and is provided office space adequate to accommodate a complete technical library, communications network, (telephone, telegraph, facsimile copier) and adequate storage files for routine correspondence. The Field Service Representative is required to provide frequent operations reports on the operator's fleet. In addition, he immediately reports unusual operating problems and/or maintenance findings as they become known. Technical inquiries from the operator are also submitted for response within a specified time frame. The Field Service Representative also provides a periodic activity report that includes the operating time and cycles of each aircraft or engine to enable tabulations and compilation of actual aircraft operating hours and handlings.

Once received by the manufacturer, operational data is organized, filed, and distributed to appropriate personnel for review and analysis. Some companies track trends and frequencies on a periodic basis so that potential problem areas can be identified for corrective action. SDR's, for example, are most useful in the area of monitoring structural problems and higher level system and airplane anomalies which would not appear in other data systems.

Regardless of the source, these data are analyzed, usually by a specialty department in the company, and significant findings are provided to design, quality, and operational functions within the company for application to future products and procedures and consideration for changes to current items through service bulletins, manual revisions, etc.

Depending on their product and the type of authorizations granted to them by the FAA, manufacturers are also required to report specified problems and events to the FAA if they do not have knowledge that an operator has already provided such information. In addition, the larger manufacturers maintain extensive communications systems directly with their customer operators worldwide. Again, the specifics and names vary among companies, but there is consistency in policy. Generally, for the most serious events, there is a hierarchy of communication media ranging from less that 24 hours by TWX or telephone conversation to both the FAA and operators, to annual or longer periodic meetings with operators to discuss and exchange views on maintenance and operational problems and procedures. Between these extremes are any number of other communication methods. The operator is placed on automatic distribution for applicable product letters, service bulletins, TWX's, maintenance plans, support equipment information, service related study items, operational occurrence reports, maintenance oriented magazines and many others.

For operators purchasing new products, the communications systems are set in motion well ahead of actual first delivery. Face-to-face meetings establish mutual requirements and methods. Training requirements are identified and normally include classroom activity as well as distribution of training material. Technical publications, including Maintenance Manuals, Structural Repair Manuals, Non-Destructive Test Manuals, Component Repair Manuals, Illustrated Parts Catalogs and numerous Supplier Manuals, to mention a few, are distributed with a requirement for scheduled revision service. Provisioning conferences are conducted to identify spare parts requirements, and an initial provisioning list is prepared--subject to continuous revision--based on operator feedback from actual service experience. Maintenance Planning and Support Equipment Conferences are also held to develop a maintenance plan and equipment requirements, including facilities, with each again subject to continuous revision based on operator feedback from actual service experience.

If any criticism is warranted in the area of communication between a major manufacturer and the FAA or its customers, it is not in regard to the amount and number of things reported. Rather, it is the very extensiveness of the system that can, and has, allowed significant items to go initially unrecognized as such and thereby not receive the prominence in the reporting medium that they deserve.

This potential is present in all the reporting systems previously described, as many different people must handle large quantities of reported items, and make judgments as to the significance of the event, often with little detailed information.

On balance, we believe that the industry's ongoing efforts in this area have contributed significantly to the maintenance of a safe and efficient air transportation system. History has proven the communications to be prolific and beneficial. We strive to improve the types, the methods and the candidness of these communication links to the mutual benefit of the operators, the manufacturers and the flying public. We believe further improvements should be oriented toward achieving more consistency and depth of reported information, rather than expanding the breadth and quantity of required reporting. We believe this will improve the ability to recognize potentially serious events, and reduce the masking effect of the many non-significant and cryptic reports which are of limited value and which over-burden the reporting systems.

In view of the Subcommittee's decision to expand the scope of its June 27 hearing to include an overview of fire safety standards for aircraft cabin materials, we are attaching to this statement an Appendix outlining the industry's fire safety position, together with a copy of our recently released study entitled "Fire Resistant Seat Cushions."

APPENDIX

AEROSPACE INDUSTRIES ASSOCIATION FIRE SAFETY POSITION

Because the aircraft industry is dedicated to the highest fire safety standards, commercial passenger aircraft are designed to industry standards which exceed Federal Aviation Regulations (FAR). Since 1967, our standards have changed cabin construction materials drastically. For example, high smoking plastics and low-burn resistance wood veneer for cabin linings were replaced by self-extinguishing, low-smoking materials prior to an upgrade in Federal regulations. In addition, epoxy-impregnated, glass reinforced fabrics have been replaced by phenolics, on the basis of smoke emissions and burn resistance. These factors overruled the superior manufacturing qualities of the epoxies. Smoke and toxicity have been significantly reduced by the reduction of organic materials and the substitution of sheet metal and glass fabrics. Continual aircraft weight savings programs have also reduced the quantity of organics within the cabin. In addition to cabin materials, inflatable evacuation slides were made available with thermal protective aluminized coatings in order to extend their time of usefulness in a post-crash fire situation.

Since 1967, FAA fire safety regulations have been upgraded from a horizontal maximum burn rate of four inches per minute to a requirement that materials self-extinguish in fifteen seconds when tested vertically. In addition to FAR burn test regulations, the industry tests all candidate materials for smoke emission, and uses the least smoking materials. To further scrutinize materials, laboratory and large scale tests are conducted to determine heat release rates, thermal decomposition temperatures, toxic gas emissions, oxygen index values and fire containment capabilities.

The complexity of an aircraft cabin requires a multitude of materials with a diverse range of properties. Some materials are inherently more fire resistant than others, leading aircraft designers to continually search for new and improved materials, with fire safety characteristics such as greater resistance to ignition and burn, lower smoke emission values, reduction of noxious fume generation and avoidance of high heat release values.

It should be understood that the terms "self-extinguishing" and "fire-proof" are NOT interchangeable. The cabin materials of aircraft certified since 1967 are "self-extinguishing" in accordance with the requirements of FAR 25.853. This means a material may burn when exposed to a bunsen burner flame, but will self-extinguish as required when the flame is removed. Cabin materials currently in use are the best materials available for meeting the functional requirements of the aircraft. These functional requirements could be severely compromised if arbitrary fire safety standards were indiscriminately applied.

An industry-wide assessment of aircraft fire safety was undertaken by the FAA's Special Aviation Fire Explosion Reduction (SAFER) Advisory Committee. The Committee's findings, published in 1980, highlighted the following:

- Near-term improvements in cabin fire safety can only be accomplished by new designs employing currently available materials.
- The concept with the greatest potential for reducing post-crash fire risk is anti-misting kerosene (AMK).
- Toxicity test standards do not exist for aircraft fire situations. Further, there is no agreement among specialists on the approximate magnitude (statistical) of the toxic contribution from burning interior materials relative to the contribution from burning turbine fuel or other fire-related hazards.
- There is incomplete data on the hazards of human exposure to toxic gas mixtures likely to be emitted from aircraft cabin materials or fuel during a fire.
- Irritants (gases and smoke) may have a real but unquantified effect on slowing egress from an aircraft.
- Reduction of the potential toxic threat from thermal decomposition products, through controlled selection of interior materials based on relative performance in small-scale toxicity tests with experimental animals, cannot be recommended at this time.
- For the purpose of material selection, assessment of relative toxicity, solely from results of chemical analysis for selected components of thermal decomposition products, cannot be recommended at this time.

In an effort to reduce toxic gas emissions, aircraft designers have been reducing the quantity of organic materials within the cabin and avoiding organic materials which produce excessive amounts of noxious fumes. This is the only approach available to the designer until toxicology research provides a clear understanding of the problem.

The most promising near-term fire safety improvement to the aircraft cabin is the improvement in the fire resistance of passenger seats. An exhaustive research program was conducted by government and industry to find new production seating materials. New fire resistant materials could not be found, but a concept to protect the cushion materials with a fire resistant envelope was developed. Full-scale testing has indicated that this concept will significantly reduce the thermal threat of seating materials, and it has been endorsed by the Aerospace Industries Association (AIA) in the report entitled "Fire Resistant Seat Cushions", attached hereto.

When considering passenger fire safety, statistics show that the most severe threat to survivability is the thermal threat from a post-crash fuel fire. Anti-misting kerosene (AMK) is the most promising solution to this problem and should be pursued vigorously with adequate research funds.

After the SAFER committee completed its work, the AIA Transport Airworthiness Requirements Committee (TARC) formed a project group to address in-flight and post-crash fire threats. Specifically, this project group is charged with (1) establishing fire scenarios to be addressed, (2) determining ignition sources, combustibles and propagation methods to be considered, (3) recommending to the FAA and NASA large-scale tests that will be required to establish needed data. The AIA-TARC group will continue to work with NASA, the FAA and the Air

Transport Association (ATA) to evaluate possible solutions to the most severe threat level scenarios defined. The committee will present its position during 1983.

The aircraft industry uses a small portion of the non-metallic materials produced for the industrial world. Because of this, the material suppliers are not motivated to expend their own resources to develop material characteristics to satisfy our unique needs. The current aircraft research programs directed at developing better materials must be pursued, and we trust that both NASA and the FAA will continue to aggressively support these efforts. It is our hope that continuing research will show as much progress in the next 20 years as we have been able to achieve in the last 20 years.

FIRE RESISTANT SEAT CUSHIONS

A I A

Aerospace Industries Association (AIA) of America, Inc.

Transport Airworthiness Requirements Committee
Project 210-9 Final Report
June 14, 1983

SUMMARY

Several events and programs in 1977 through 1980 emphasized the likelihood of significant contribution by the urethane seat cushions to airplane cabin fires. In 1979 the SAFER (Special Aviation Fire and Explosion Reduction) Advisory Committee to the FAA formulated the short term recommendation to develop fire blocking layers for urethane cushions and the long term recommendation to develop low smoking, fire resistant aircraft seat cushion foam. The recommendations were formalized in 1980 with the final SAFER report. The AIA-TARC Project 210-9, Fire Resistant Seat Cushions, was established to provide cohesive support by airplane manufacturers to the FAA to define guidelines for seat cushion constructions with improved fire performance.

The AIA effort has been part of a closely coordinated program with the FAA and NASA including testing, data analysis and cost benefit evaluation. The analysis of laboratory fire test data and full scale fire test results on candidate seat cushion configurations has led the 210-9 project to technical conclusions and recommendations for improving and evaluating the fire resistance of airplane seat cushions.

Although specific, quantitative test values could not be established for seat cushion fire resistance, an available seat cushion fire blocking layer has been defined as exhibiting a desirable level of fire performance, and test methods have been identified for screening and validating candidates for comparative performance.

1.0 INTRODUCTION

Presented herein are the results, conclusions and recommendations from an AIA TARC Project Study on fire resistant airplane seat cushions.

2.0 BACKGROUND

In 1980 the AIA-TARC Project 210-9 Fire Resistant Seat Cushions" was established to define guidelines for airplane seat cushion construction that would provide improved fire performance. Primary events leading to the project initiation were:

- 1977 - A NASA contract was initiated with the McDonnell Douglas Corporation to evaluate new materials and configurations to improve fire properties of aircraft seat cushions as part of the FIREMEN (Fire Resistant Materials Engineering) program.

- 1979 - A destructive fire occurred in a Bay Area Rapid Transit (BART) car involving seat cushions with urethane foam. Dr. Brady Williamson (University of California - Berkley) was contracted to study the fire. McDonnell Douglas was contracted by BART to test in full scale fires three seat cushion configurations utilizing different foams and coverings.

- 1979 - NASA-JSC conducted full scale tests on airplane interior fire performance using jet fuel fires. The Boeing Company conducted similar tests simulating flame exposure with heating lamps and propane flames. The NASA contract with McDonnell Douglas continued, encompassing laboratory tests and both fuel-fed and simulated fire full scale tests of seat cushion configurations.

- 1979 - SAFER (Special Aviation Fire and Explosion Reduction) Advisory Committee (to the FAA) formulated recommendations that in the short term fire blocking layers should be developed for urethane cushions and in the long term low smoking, fire resistant aircraft seat cushion foams should be developed. The AIA participated in development of the recommendations based on data from the preceding events.

3.0 OBJECTIVE

When Project 210-9 was first established, it was proposed that properties for acceptable seat functional performance would be identified to support guidelines for improved fire performance based on available materials meeting the functional properties objectives. In March 1982, it was agreed within the project that meeting these objectives was not practicable using seat design experience readily available within the AIA and could not be accomplished within a reasonable time. Experience and discussions with the airline and seating industries had shown that many of the passenger seating functional properties are based subjectively upon "comfort". In addition, seat functional properties are not determined solely upon seat cushion materials, but are highly dependent upon seat and seat cushion design.

The project objective was then revised to define a desirable level of fire resistance consistent with materials available giving reasonable consideration to durability, cost, weight, apparent comfort, etc. Airlines and seat manufacturers must collaborate on passenger seat and seat cushion design to meet specific functional needs while providing the recommended level of fire resistance. The AIA members are involved in flight crew and attendant seat design considerations for improved fire resistance and functional requirements; but, the small number of such seats makes cost and weight less significant than for the passenger seats.

4.0 APPROACH

For the purpose of this project, the seat cushion is defined as the fabric, cushion reinforcement (slip cover), fire blocking layer (where used) and the foam. The approach established to gain the objective stated in section 3.0 was:

- Gather data/conclusions/recommendations from existing seat cushion tests, development programs, and involved industry representatives.

- Evaluate the results of programs to establish fire resistance guidelines for functional seat cushions.

- Draft guidelines for fire resistant seat cushions identifying those areas in which lack of data, available materials or fabrication and [illegible] prevents or limits industry capability to develop guidelines.

- Apprise government and industry of needed R&D.

- Participate with R&D where appropriate.

4.1 Seat Cushion Test and Development Program Review

In 1980 there were many programs in progress or proposed which related to this project. Those reviewed and evaluated were:

a. NASA-ARC/McDonnell Douglas Corporation Fire Resistant Seat Program
b. NASA-JSC/McDonnell Douglas Corporation Cabin Fire Simulator (CFS) Seat Cushion Burn Tests
c. FAA/NASA-ARC/McDonnell Douglas Corporation C-133 Post Crash Cushion Burn Tests
d. FAA/DuPont C-133 Cushion Burn Tests with Vonar and FS-200 Fire Blocking
e. NASA-JSC 737 Tests of Improved Fire Resistant Interior Components, e.g., linings and seats

f. NASA/Southwest Research Institute Room Size Calorimeter Tests
g. AMI Lightweight Passenger Seat Employing an Advanced Composites Seat Structure
h. BART/McDonnell Douglas Corporation Evaluation of Seat Cushions
i. NASA-JSC/Solar (International Harvester)/Weber Aircraft Evaluation of Polyimide Seat Cushions
j. Pan American Airlines/DuPont In-Service Evaluation of Vonar Fire Blocking
k. American Airlines/Solar In-Service Evaluation of Polyimide Seat Cushions
l. FAA/NASA-ARC/McDonnell-Douglas Corporation Short Term Fire Blocking Optimization Program (Proposed in 1980)
m. FAA/NASA Interagency C-133 Fire Tests of Baseline and Improved Cabin Interiors

4.2 Government and Industry Cooperation

After reviewing the programs, the TARC project reached several conclusions. An AIA letter relating these results was sent to the FAA in early August 1981. This letter and the formal FAA replies are in Appendix A. In January 1981, the TARC project had met with the FAA and NASA at the Technical Center and had attended a NASA-sponsored review of fire resistant seat cushion programs at Houston in February 1981. By August 1981, the results of the AIA program review had been discussed with the FAA Technical Center personnel. The FAA arranged a meeting of NASA, FAA and AIA representatives to formulate plans in research and development on the fire resistant seat cushion concept. The letters in Appendix 10.1 attest to the beneficial results of the cooperative planning conducted by those involved.

4.3 Government and Industry R&D Response

Briefly, the reviews and discussions ended with the following major conclusions for action.

- The high density of neoprene (i.e. LS-200) is unacceptable for complete airplane cushions and the functional properties of polyimide foam are unproven; therefore, fire blocking is still the only currently viable solution for improved seat cushion fire resistance. NASA-ARC under an interagency agreement with the FAA would optimize for cost and weight possible state-of-the-art fire blocking configurations utilizing laboratory scale fire test methods. This would demonstrate concept feasibility and practicality.

- The FAA Technical Center C-133 fire test facility is the best available instrument to evaluate the actual fire performance characteristics; however, baseline and proposed configurations need evaluation at conditions other than just the large post-crash scenerio currently being tested. The FAA would continue to use the near-maximum post-crash scenerio but would also test under ramp (pre-flight, post-flight) and in-flight conditions as well. The FAA/NASA Interagency Agreement would also provide for McDonnell Douglas to test full scale configurations with fire exposure simulated by radiant heat from quartz lamps and ignition with a propane torch.

- Laboratory and/or small scale tests are needed for configuration screening, certification, and quality control purposes. Eleven seat cushion configurations were established for evaluation by fire tests. NASA-ARC would provide uniform material samples for specimen construction, and NASA, FAA, Lockheed, McDonnell Douglas and Boeing would participate in laboratory/small scale tests. Results would be compared to large scale test data obtained at the FAA Technical Center and McDonnell Douglas.

5.0 FULL SCALE FIRE TEST RESULTS

Not all full scale tests planned by the FAA have been completed. Also, not all those conducted have been documented formally. However, the FAA has informally reported Technical Center test results to this TARC project and the tests conducted by McDonnell Douglas have been documented. Sufficient data is available to establish desirable fire resistance for state-of-the-art fire blocking materials.

5.1 FAA C-133 Fire Tests

A surplus C-133 airplane has been modified by the FAA Technical Center to accomodate full scale fire testing of airplane interior components. The testing can be conducted under simulated conditions for wide-body commercial jet transport operations. The test facility and results of seat cushion fire blocking tests are described in more detail in Reference 1.

In each test the blocking layer material is installed as an interliner between the upholstery cover and foam cushion. Table 1 is a list of candidate blocking layer materials evaluated. Table 2 describes the ignition sources for each type fire tested. The significant findings were summarized in Reference 1:

> "Based on the realistic cabin fire tests and analysis described in this paper, and on the seat cushion blocking layer materials evaluated and the types of fire test conditions employed, the following are the significant findings:
>
> (1) Seat cushion fire blocking layer materials such as neoprene foam or aluminized high-temperature fabrics can prevent ramp and in-flight fires which become out of control when initiated at an unprotected seat and left unattended.
>
> (2) Seat cushion fire blocking layer materials can significantly increase the safe time available for evacuation during specific types of postcrash cabin fire scenarios.

TABLE 1

MATERIALS EVALUATED IN C-133 FULL SCALE TESTS

MATERIAL	CHEMICAL COMPOSITION
Baseline	
(1) Wool (90%)/Nylon (10%) Fabric	
(2) FR Urethane Foam	
Foam Blocking Layer	
(3) Vonar®, 3/16 in. thick, 24 oz/yd^2	FR polychloroprene
(4) LS-200, 3/8 in. thick, 34 oz/yd^2	FR polychloroprene
Fabric Blocking Layer	
(5) Norfab®, 13 oz/yd^2	Blend of predominantly aromatic polyamide fibers wrapped around a fiberglass fire core, aluminized outer surface
(6) Preox®, 11 oz/yd^2	Heat stabilized polyacrylonitrile, aluminized outer surface

(1) Type of seat upholstery cover used in all tests
(2) Fire-retardant
(3) Registered Trademark, DuPont Co., Wilmington, Delaware
(4) Product of Toyad Corporation, Latrobe, Pa
(5) Registered Trademark, Norfab Corporation, Morristown, Pa
(6) Registered Trademark, Gentex Corporation, Carbondale, Pa

TABLE 2
IGNITION SOURCES FOR FAA C-133 FIRE TESTS

TYPE OF FIRE	IGNITION SOURCE
Ramp	o Plastic trash bag filled with approximately 18 ounces of paper towels and newspaper
In-Flight	o Cigarette o Newsprint (4 double sheets) o Gasoline (1 pint) o Simulated nylon flight bag (contents 2 shirts and 2 double sheets of newsprint approximately 22 ounces)
Postcrash	o Jet fuel (80-square-foot pan containing 50 gallons of fuel)

(3) Under severe fire conditions, such as a postcrash fuel fire, neoprene foam materials are more effective seat cushion blocking layers than aluminized high-temperature fabrics.

(4) Fire-retardant urethane foam can be replaced by nonfire-retardant urethane foam in aircraft seat cushions covered with a blocking layer material without essentially any loss in in-flight fire protection."

A review of reference 1 reveals that except for the severe post-crash fire conditions, the aluminized fabric fire blocking performed as well, or nearly as well, as the much heavier foam blocking layers. The results implied that in many post-crash fire conditions the aluminized fabric would be nearly as effective as the foam blocking. Only in the very severe post-crash fire condition was the foam fire resistance appreciably better than that of the aluminized fabric. However, the protection afforded the cushion by the aluminized fabrics delayed development of hypothetically unsurvivable cabin thermal conditions by 70% as long as did use of a foam blocking layer.

5.2 FAA/NASA/McDonnell Douglas Corporation Fire Tests

Under a FAA/NASA Interagency Agreement, NASA-ARC contracted the Douglas Aircraft Company of McDonnell Douglas Corporation to conduct simulated fire tests of thirteen seat cushion configurations. The tests were conducted in the Douglas Cabin Fire Simulator (CFS) using a quartz lamp radiant energy panel and a propane pilot flame. Reference 2 describes the test facility and the results. The test article consisted of two full-size simulated seat cushions (two bottoms and two backs) situated side by side on a frame suspended from a weighing apparatus. The radiant heat source was arranged as a flat vertical panel parallel to, and six inches from, the outside edges of one seat bottom and back (Figure 1). The radiant incident flux measured in a plane parallel to, and six inches from, the panel was approximately 10 watts per square centimeter. This is representative of the heating rates which might be experienced by seats near an open door or a large fuselage rupture in a large post-crash fire situation.

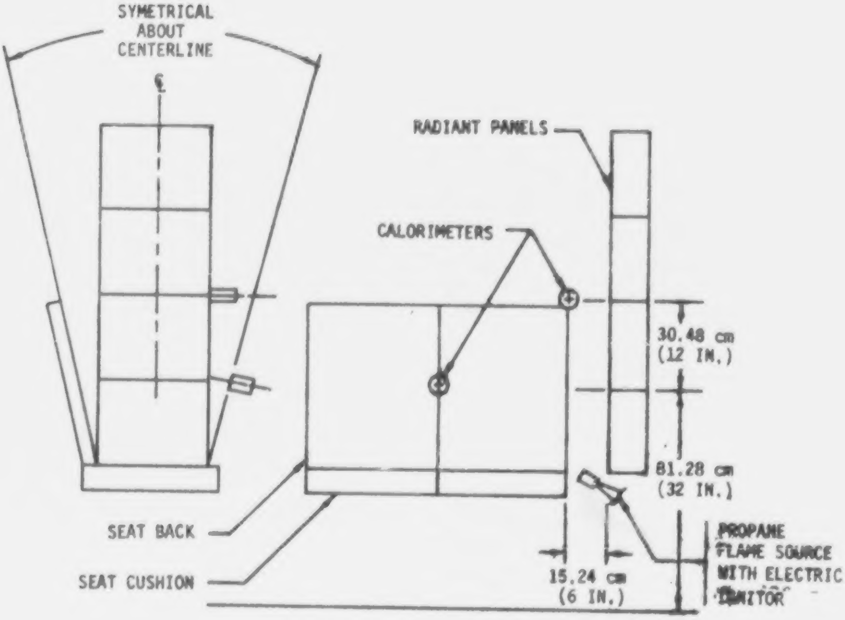

SYMETRICAL
ABOUT
CENTERLINE
℄
RADIANT PANELS
CALORIMETERS
30.48 cm
(12 IN.)
81.28 cm
(32 IN.)
SEAT BACK
SEAT CUSHION
15.24 cm
(6 IN.)
PROPANE
FLAME SOURCE
WITH ELECTRIC
IGNITOR

FIGURE 1 SET UP FOR McDONNELL DOUGLAS FULL SCALE FIRE TESTS

Thirteen seat cushion configurations were tested with five minutes of radiant heat exposure. After fifteen minutes each test was considered complete. Post-test photos were taken and seat residue was weighed.

The thirteen seat cushion configurations are listed in Table 3 and their materials are described in Table 4. Both tables are reproduced from Reference 2. Results of weight loss analysis are shown in Figure 2 from Reference 2. Reference 2 concluded and recommended the following:

CONCLUSIONS

> "Urethane foam decomposes into a volatile gas when exposed to a severe heat source. If this generated gas can be contained in such a manner as to prevent its igniting or to control the rate at which it burns, the severity of the fire will be reduced. This was clearly shown in the testing of standard cushion constructions with a protective covering, "fire-blocking", enveloping the urethane foam.
>
> When the fire blocking was able to contain the decomposing urethane by-products, i.e., fluid and gas, the cushions closest to the heat source burned with less intensity, generated a minimum of heat and were unable to ignite the adjacent cushions. However, when the decomposing urethane fluid was able to escape from the fire-blocking envelope and pool on the floor, an uncontrolled fire erupted which resulted in total burning of all cushion materials.
>
> Some of the Norfab and Celiox materials utilized aluminum coatings. It was not the aluminum's reflecting properties which made the cushions perform well as it was its non-permeable properties. This coating helped contain the decomposed by-products and prevented propagation to the adjacent cushion.

TABLE 3
SEAT CONSTRUCTIONS EVALUATED IN McDONNELL DOUGLAS FULL SCALE FIRE TESTS

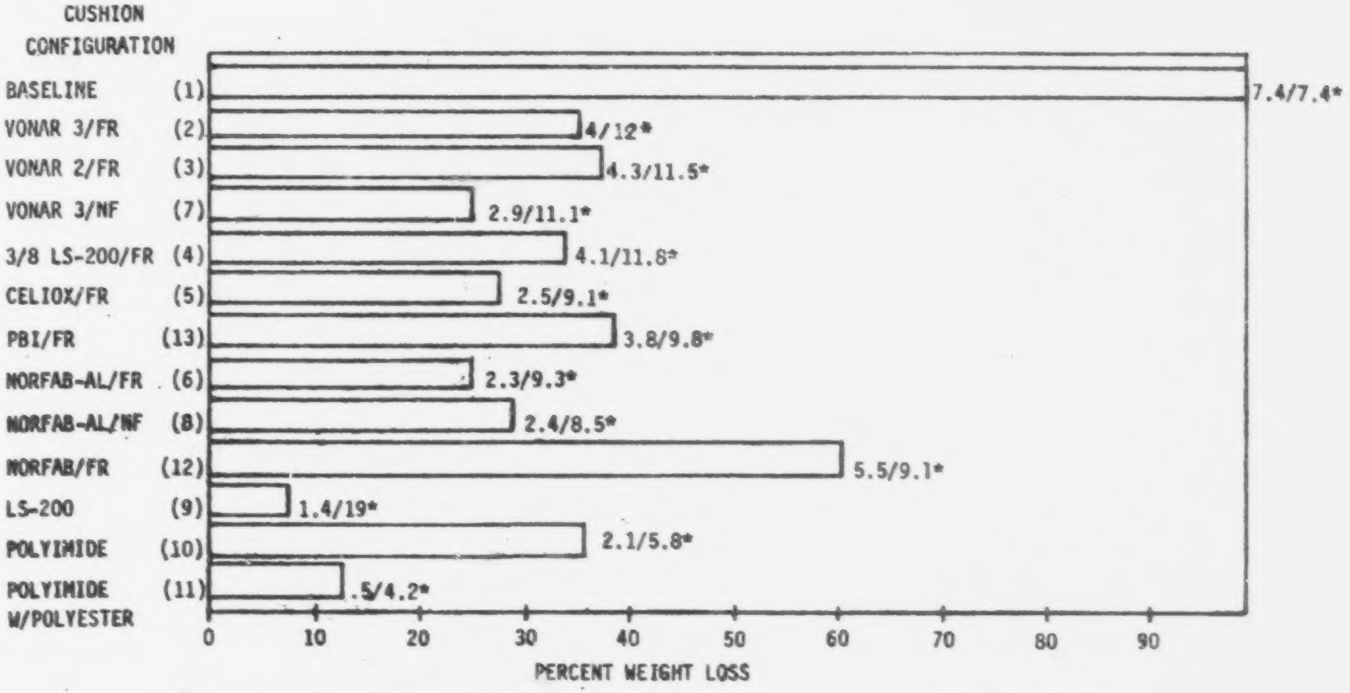
CONSTRUCTION NUMBER	DECORATIVE UPHOLSTERY	SLIP COVER	FIRE BLOCKING	FOAM
1	Wool-Nylon	None	None	F. R. Urethane *
2	Wool-Nylon	Cotton-Muslin	Vonar-3	F. R. Urethane
3	Wool-Nylon	Cotton-Muslin	Vonar-2	F. R. Urethane
4	Wool-Nylon	None	3/8 LS 200	F. R. Urethane
5	Wool-Nylon	None	Celiox 101	F. R. Urethane
6	Wool-Nylon	None	Norfab 11 HT-26-AL	F. R. Urethane
7	Wool-Nylon	Cotton-Muslin	Vonar-3	N. F. Urethane *
8	Wool-Nylon	None	Norfab 11 HT-26-AL	N. F. Urethane
9	Wool-Nylon	None	None	LS 200 Neoprene
10	Wool-Nylon	None	None	Polyimide
11	Polyester	None	None	Polyimide
12	Wool-Nylon	None	Norfab 11 HT-26	F. R. Urethane
13	Wool-Nylon	None	PBI	F. R. Urethane

* F. R. Urethane (Fire Retarded Urethane)

* N. F. Urethane (Non-Fire Retarded Urethane)

TABLE 4
MATERIALS IN THE McDONNEL DOUGLAS FULL SCALE FIRE TESTS

MATERIAL	SOURCE
#2043 urethane foam, fire-retardant (FR), 0.032 g/cm^3 (2.0 lb/ft^3) 43 ILD	North Carolina Foam Ind. Mount Airy, NC
Urethane foam, non-fire retardant (NF), 0.022 g/cm^3 (1.4 lb/ft^3) 24-35 ILD	CPR Division of Upjohn Torrance, Ca.
Vonar-3, 3/16-inch thick with Osnaburg cotton scrim (23.5 oz/yd^2) .079 g/cm^2	Chris Craft Ind. Trenton, NJ
Norfab 11HT26-aluminized (12.9 oz/yd^2) .044 g/cm^2, aluminized one side only	Amatex Corporation Norristown, Pa.
Gentex preox (celiox) (10.9 oz/yd^2) .037 g/cm^2, aluminized one side only	Gentex Corporation Carbondale, Pa.
Wool nylon (0.0972 lb/ft^2) .0474 g/cm^2 90% wool/100% nylon, R76423 sun eclipse, azure blue 78-3080 (ST7427-115, color 73/3252)	Collins and Aikman Albermarle, NC
Vonar 2, 2/16 inch thick, .068 g/cm^2 (19.9 oz/yd^2) Osnaburg cotton scrim	Chris Craft Industries Trenton, NJ
LS-200 foam, 3/8" thick (33.7 oz/yd^2) .115 g/cm^2 LS-200 foam, 3-4 inches thick (7.5 lb/ft^3) 0.12 g/cm^3	Toyad Corporation Latrobe, Pa.
Polyimide Foam (1.05 lb/ft^3) .017 g/cm^3	Solar Division, International Harvester San Diego, Ca.
100% polyester (10.8 oz/yd^2) .037 g/cm^2 4073/26	Langenthal Corporation Bellevue, Wa.
Norfab 11HT26 Approximately (11.3 oz/yd^2) .038 g/cm^2	Gentex Corporation Carbondale, Pa.
PBI Woven Cloth Approximately (10.8 oz/yd^2) .037 g/cm^2	Celanese Plastic Company Charlotte, NC



* WEIGHT LOSS/TOTAL INITIAL WEIGHT IN POUNDS

FIGURE 2 WEIGHT LOSS IN McDONNELL DOUGLAS FULL SCALE FIRE TESTS

Had the seams held and all the gases vented out the back of the cushions and away from the heat, the decomposing of the cushions may have been even less severe. Undoubtedly, the reflective properties had an effect in slowing down the decomposing of the urethane, but only by a few seconds. The reason being the emissivity and thermal conductivity of the aluminum coating was inadequate to resist the severe radiant energy being applied to the surfaces.

The charred foam fire-blocking layers did not act primarily as a heat barrier as they did a liquid and gas barrier. In the cushions farthest from the radiant source, the urethane foam still thermally decomposed. It formed a pocket of gas behind the intact charred envelope. This was verified in post test inspection. However, the gas escaped slowly and only created a small pilot flame. The flame extinguished itself when the radiant energy source was switched off.

The polyimide cushions are examples of a foam which thermally decomposes at high temperatures and generates gas and char but no noticeable liquids. The wool-nylon upholstery trapped gases between itself and the foam. When these gases ignited, the foam decomposed rapidly. The polyester upholstery decomposed from the cushions fast enough to prevent the trapping of these gases. Subsequently, the foam in the cushions decomposed at a slower rate. From these tests, it is concluded that no matter the foam used as a core for the cushion, if the gases generated by the foam can be expelled or contained in such a manner as to prevent their burning or reduce the rate at which they burn, a severe fire can be avoided or delayed. It is further concluded that if the thermal decomposition characteristics can be altered so as to slow down the generation of gas, the time before a fire becomes severe can be extended to the point where appropriate extinguishment of the fire may be possible."

RECOMMENDATIONS

> "It is recommended that a study be made to incorporate cushion designs and fire-blocking materials which are thermally stable and nonpermeable to urethane fluids and gases to prevent or reduce the rate at which a seat cushion burns.
>
> This study should include considerations for wearability of fire blocking layers, fatigue life of cushion foams and methods of venting decomposition gases from the cushion assembly. Test results from this program have shown that seam constructions significantly affect cushion burn performance. Therefore, seam constructions previously studied by the NASA seat program should be reconsidered in future cushion designs.
>
> It is also recommended to use these studies as a basis to develop a design standard for a fire resistant passenger seat. This standard must be supported by inexpensive laboratory burn test methods that can verify these standards are being met."

As was stated in the conclusions, Figure 2 shows that all the fire blocking layers reduced the percent of total material burned. It is also apparent that the aluminized fabrics (configurations 5, 6 and 8) were more effective than the non-aluminized fabrics (configuration 12). The performance of the aluminized fabrics in these tests is consistent with that found in the tests with real fires (Reference 1) discussed in Section 5.1.

6.0 LABORATORY FIRE TEST RESULTS

August 25-26, 1981, FAA, NASA, and AIA technical representatives met at the FAA Technical Center to coordinate development of small scale fire test criteria for seat cushions with improved fire resistance. Data from small scale tests conducted by the participants on various seat cushion configurations were reviewed. A concensus developed that no test method was adequately defined and sufficiently available to establish a "GO-NO GO" standard for seat cushions with improved fire resistance. Therefore it would be necessary to establish a configuration standard considered to have an acceptable performance within state-of-the-art materials availability. Any proposed seat cushion systems could be compared to the standard for equivalency.

The representatives agreed that the primary fire blocking characteristics pertinent to fire performance are probably fire spread, time to foam fire involvement and heat release rate (for cushion, including blocking and foam). Smoke and toxicant release should not be a primary concern with materials presently being considered as control of these properties is beyond the state-of-the-art test methods. However, it is assumed that unusually high smoke or known high toxicant producers would not be used.

It was suggested that urethane foam wrapped in 181 E-glass fabric be considered a possible standard. Such a standard, although unusable as a practical seat cover, would be readily available for comparison tests. The samples would be consistent in quality and properties and would probably provide an acceptable degree of fire blocking for comparison purposes. It was agreed that the concept was desirable but that the selection of glass fabric would have to be validated by large and small scale tests.

Since all previous small scale testing had been accomplished at different places with different test apparatus on different seat cushion fire blocking configurations, it has been difficult to evaluate the degree of data correlation from one test to another and with large scale test results. It was decided that a fire retardant foam baseline and six fire blocking concepts on fire retardant foam should be tested in the available test facilities at participating organizations for mutual comparison, and for comparison to C-133 and CFS results. In addition, two of the fire blocking materials would be tested on a non-fire retardant foam having the same comfort and functional properties as the 2.2 pcf F.R. foam. Unprotected polyimide and LS-200 foam specimens were added to the test configuration list to make a total of eleven. It was hoped that a test for fire blocking performance could indicate the acceptability of new fire resistant cushioning materials and concepts as well. In all cases the same decorative wool upholstery would cover the specimens; however, slip covers would not be used as part of the tested configuration unless the slip cover is considered a portion of the fire blocking. The configurations selected for test are shown in Table 5, reproduced from Reference 3. The configurations will be designated by the numbers shown throughout this report section.

Some of the test methods available to participants may be operated readily at several selected heating rates (i.e., the NBS Smoke Density Chamber and the OSU). It was agreed that wherever possible, on these facilities, testing should be done at 2.5, 5.0 and 7.5 W/cm^2 to determine performance over a range of heating rates the cushions may most likely encounter in airplane fires. To insure specimen uniformity at the testing agencies, FAA and NASA-ARC ordered and distributed all materials as part of the FAA/NASA interagency agreement. The testing conducted and the results are summarized in the following sub-sections.

TABLE 5

SEAT CUSHION CONFIGURATIONS FOR FIRE TEST METHODS EVALUATION

CONFIG-URATION	FOAM	FIRE BLOCKING LAYER (FBL)	FBL kg/m^2	WEIGHT oz/yd^2	SUPPLIERS OF FIRE BLOCKING LAYERS
1	FR urethane	none			
2	FR urethane	Vonar ® -3, 0.48 cm (3/16 in)*	0.91	27.07	Chris Craft Industries 1980 East State St. Trenton, NJ 08619
3	FR urethane	Vonar ® -2, 0.32 cm (2/16 in)*	0.67	19.97	Chris Craft Industries 1980 East State St. Trenton, NJ 08619
4	FR urethane	LS-200 neoprene ® 0.95 cm (3/8 in)	1.15	33.7	Toyad Corporation 16 Creole Drive Pittsburg, PA 15239
5	FR urethane	Preox ® 1100-4 aluminized Preox ® fabric, plain weave, neoprene CTD, P/N 1299013	0.39	11.53	Gentex Corporation P. O. Box 315 Carbondale, PA 18307
6	FR urethane	Norfab ® 11HT-26-A1 aluminized on one side, 25% Nomex ® 70% Kevlar ®, 5% Kynol ®, weave structure 1x1 plain	0.40	11.8	Amatex Corporation 1032 Stonabirdge St. Norristown, PA 19404
7	FR urethane	181 E-Glass			Uniglass Industries Statesville, NC
8	NF urethane	Vonar ® -3, 0.48 cm (3/16 in)	0.92	27.07	Chris Craft Industries 1980 East State St. Trenton, NJ 08619
9	NF urethane	Norfab ® 11HT-26-A1	0.40	11.8	Amatex Corporation 1032 Stonabirdge St. Norristown, PA 19404
10	LS-200 Neoprene ®	none			
11	Polyimide	none			

® Registered Trademark

NOTES ON TABLE 5:

All decorative upholstery is a wool/nylon blend fabric (R76423 Sun Eclipse, Azure Blue, 78-3880) by Collins & Aikman, Albemarle, NC

Suppliers of Foams:

FR urethane (No. 2043 FA foam, density of 29.9 kg/m^3 or 1.87 lb/ft^3):
North Carolina Foam, P. O. Box 1112, Mt. Airy, NC 27030

NF urethane (medium firm, ILD32, density of 23.2 kg/m^3 or 1.45 lb/ft^3):
Foam Craft, Inc., 11110 Business Circle Dr., Cerritos, CA 90701

Polyimide foam: International Harvester, 701 Fargo Ave., Elk Grove Village, IL 60007

LS-200 neoprene foam: Toyad Corporation

* The Vonar was on a cotton fabric carrier.

6.1 NASA-ARC Small Scale Tests

The most extensive program of laboratory scale testing and analysis of the eleven cushion configurations was conducted by NASA-ARC through the FAA/NASA interagency agreement. This program also included the large scale simulated fire tests conducted by McDonnell Douglas (see 5.2) and weight/cost/durability studies. The entire program is reported in reference 3. The laboratory scale tests and results will be summarized here. Conclusions and recommendations of the program will be included in sections 7.0 Comparison of Laboratory and Full Scale Test Results and 8.0 Conclusions and Recommendations.

6.1.1 NASA-ARC T-3 Burner Tests

A series of initial screening tests for potential candidate blocking layers was conducted by Scientific Service, Inc. The objective was to compare the effects of thermal exposure on several of the seat cushion configurations by measuring the time that it took to raise the surface temperature of the foam material to 300°C (598°F) using the T-3 burner described in reference 3 Appendix A. Heat fluxes tested were 11.3W/cm^2 (9.95 Btu/ft^2 sec) and 8.5 W/cm^2 (7.49 Btu/ft^2 sec). Results in order of descending time for the foam to reach 300°C were:

CONFIGURATION NO.	FIRE BLOCKING LAYER
4	0.95 cm(3/8 in.) LS-200
2	0.48 cm(3/16 in.) Vonar 3
3	0.32 cm(2/16 in.) Vonar 2
6	Norfab 11HT-26-Al
5	Preox 1100-4
7	181 E-Glass
1	No Fire Block Layer

The thermal threat of these tests was extreme and short foam protection times were observed. Reference 3 stated:

> "The NASA T-3 burner test results were inconclusive in determining the fire protection afforded by various fire blocking layers and foams and does not appear to offer a viable small scale testing procedure for these purposes."

6.1.2 NASA-ARC Studies of Mass Injection by Thermal Degradation

This investigation was done by San Jose State University. An NBS smoke density chamber was modified to measure weight loss as well as smoke density.

The tests were conducted on 3 in. x 3 in. specimens with 1/2 inch thick cushioning foam wrapped with the appropriate fire blocking layer and the upholstery material. The sample was exposed to only radiant heating with no pilot flame. Specimen weight was measured continuously throughout the test. Complete testing procedures and setup may be found in Reference 3.

Tests were conducted at incident heat fluxes of 2.5, 5.0 and 7.5 W/cm^2. From the weight loss data at 2 minutes into the radiant heat exposure, the specific mass injection rate (m) was calculated for ten of the eleven configurations.

$$\dot{m} = \frac{\text{(weight loss)}}{\text{(area of sample exposed) (time elapsed)}} \qquad \frac{g}{cm^2\ sec}$$

The results for this calculation are shown in Figures 3 and 4 developed from data in Reference 3. It can be seen that all experimental configurations demonstrated significantly lower mass injection rates than the baseline, configuration 1, when exposed to either 2.5 or 5.0 W/cm^2. The reduction in mass injection rate was not as significant for some fire blocking layers with 7.5 W/cm^2 exposure.

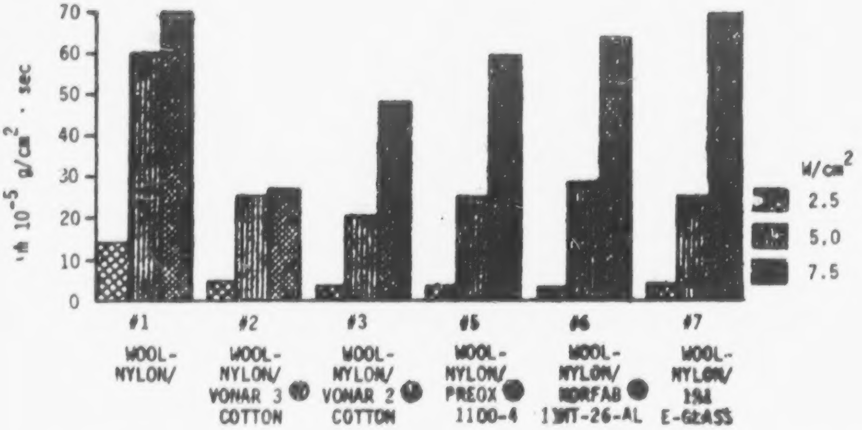
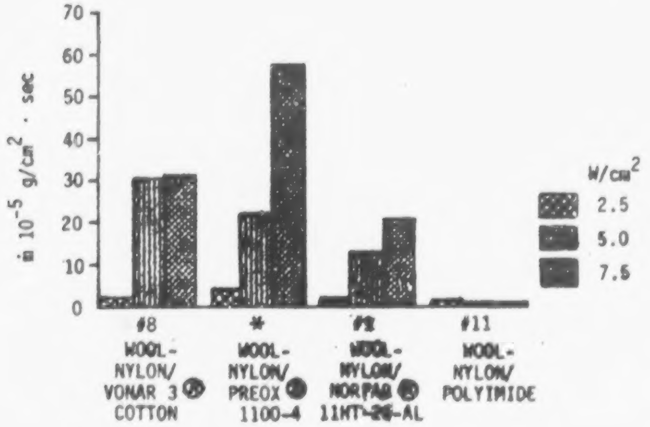


FIGURE 3: SPECIFIC MASS INJECTION RATE OF F.R. URETHANE FOAM AT 2 MIN.

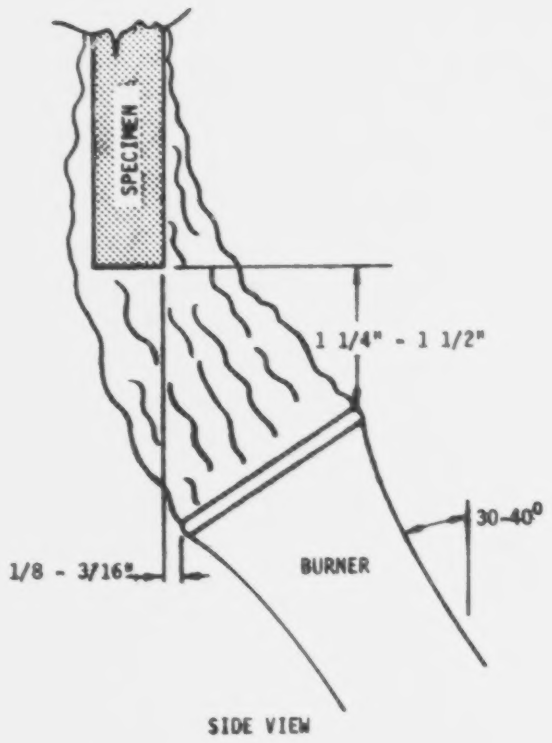


* CONFIGURATION IN ADDITION TO ORIGINAL 11

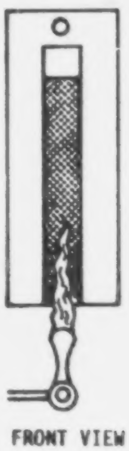
FIGURE 4: SPECIFIC MASS INJECTION RATE OF N.F. URETHANE AND POLYIMIDE FOAMS AT 2 MIN.

6.2 Lockheed Meeker Burner Tests

The Lockheed Aircraft Company (Lockheed-California Company) conducted tests on the eleven configurations using the specimen holder developed for compliance with tests required in FAR 25.853 and a Meeker burner. The set-up is described in Figure 5. Adjustment of the flame to specified temperatures is defined in Figure 6. Samples fabricated as shown in Figure 7 were tested with 60 seconds exposure to the Meeker burner flame. The results of the flame test are summarized in Table 6. It is noted that all but the baseline demonstrated short after-flame times. All demonstrated much shorter foam burn lengths than observed for the baseline, with the neoprene blocking layers, the neoprene foam and the polyimide foam burning less than those foams protected by fabric fire-blocking. The burning intensity of the polyimide sample was significantly greater than all but the baseline. However, the length of polyimide foam burned was short. This phenomena will be discussed more in Sections 7 and 8.

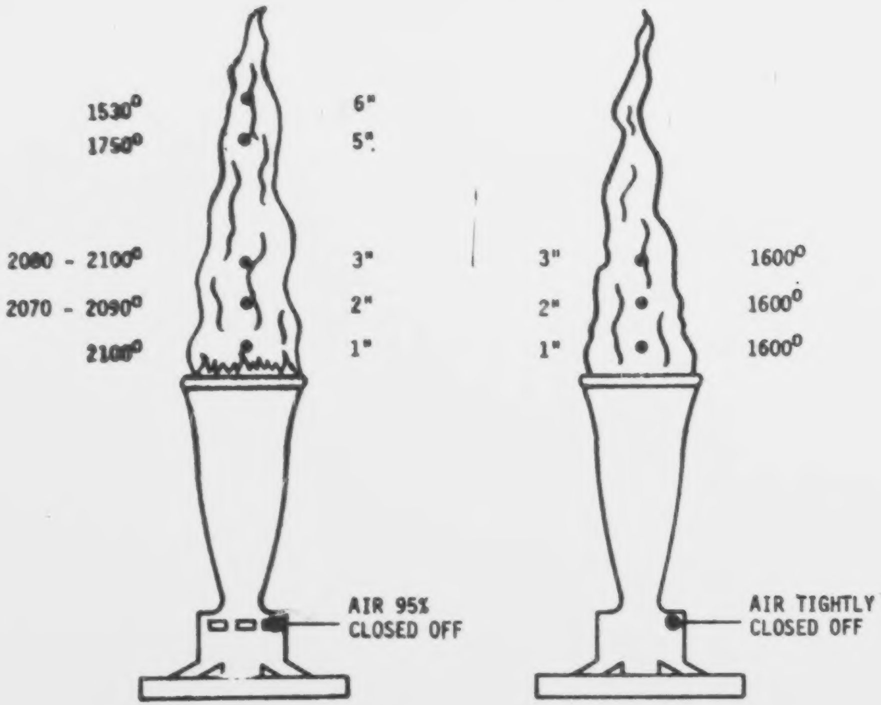

SPECIMEN
1 1/4" - 1 1/2"
30-40°
1/8 - 3/16"
BURNER
SIDE VIEW

FAR 25.853 SET-UP



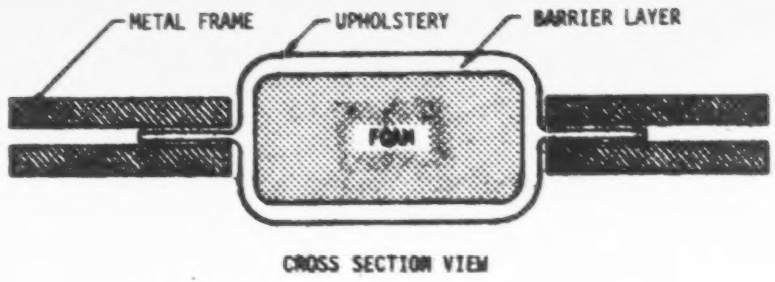
- MEEKER BURNER, AIR 95% CLOSED CENTER FLAME ON SPECIMEN
- FLAME LENGTH 6-7"
- FLAME TEMP. 2050 ± 30°F
- TIME 60 SECONDS

FIGURE 5: MEEKER BURNER FLAME TEST SETUP


1530°
6"
1750°
5"
2080 - 2100°
3"
2070 - 2090°
2"
2100°
1"
AIR 95%
CLOSED OFF
3"
1600°
2"
1600°
1"
1600°
AIR TIGHTLY
CLOSED OFF

TEMPERATURES MEASURED WITH 24 GAUGE Cr - Al THERMOCOUPLE

FIGURE 6: MEEKER BURNER FLAME TEMPERATURE ADJUSTMENT


METAL FRAME
UPHOLSTERY
BARRIER LAYER
FOAM
CROSS SECTION VIEW

FOAM	2" W x 1" T x 12" L
BARRIER LAYER	4 1/2" W x 25" L
UPHOLSTERY	4 1/2" W x 25 1/2" L

FIGURE 7: SPECIMEN CONFIGURATION FOR MEEKER BURNER FLAME TEST

TABLE 6

MEEKER BURNER FLAME TEST RESULTS

NO.	CONFIGURATION	BURN INTENSITY	BURN LENGTH, INCHES		AFTER FLAME (SECONDS)
			UPHOLSTERY	FOAM	
1	BASE	5	9 3/4	5 3/4	60+
2	VONAR 3	2	5 1/4	1/8	0-2
3	VONAR 2	2	5 1/4	5/16	0
4	LS-200	2	4 1/2	1/8	0
5	CELIOX	3	4 3/4	1	2
6	NORFAB	2	4 3/4	1 1/4	3
7	181 E GLASS	2	4 3/4	1 1/8	3
8	VONAR 3, NF	2	4 1/4	1/4	0
9	NORFAB, NF	3	5	1 1/4	0-6
10	LS-200 FOAM	2	4 1/2	1/8	0
11	POLYIMIDE	4	7	1/2	0-2

BURN INTENSITY 1 = GOOD, 5 = POOR

6.3 OSU Tests

The Ohio State University Release Rate apparatus has been evaluated extensively at many laboratories including Boeing, the FAA and McDonnell Douglas. The basic apparatus and a proposed procedure are described in reference 4. Unfortunately, the operating procedures for airplane materials have not been established, and much of the equipment has been modified to unique testing concepts of the individual laboratories. There were significant differences in the OSU testing procedures used by Boeing, the FAA Technical Center and McDonnell Douglas. Some of the more significant differences are obvious in Table 7. Because of these differences, correlation of absolute values of heat and smoke release would not be expected. Figures 8 through 13 summarize accumulated release values for specific times as related to the release from configuration No. 1 (baseline) expressed as 100%.

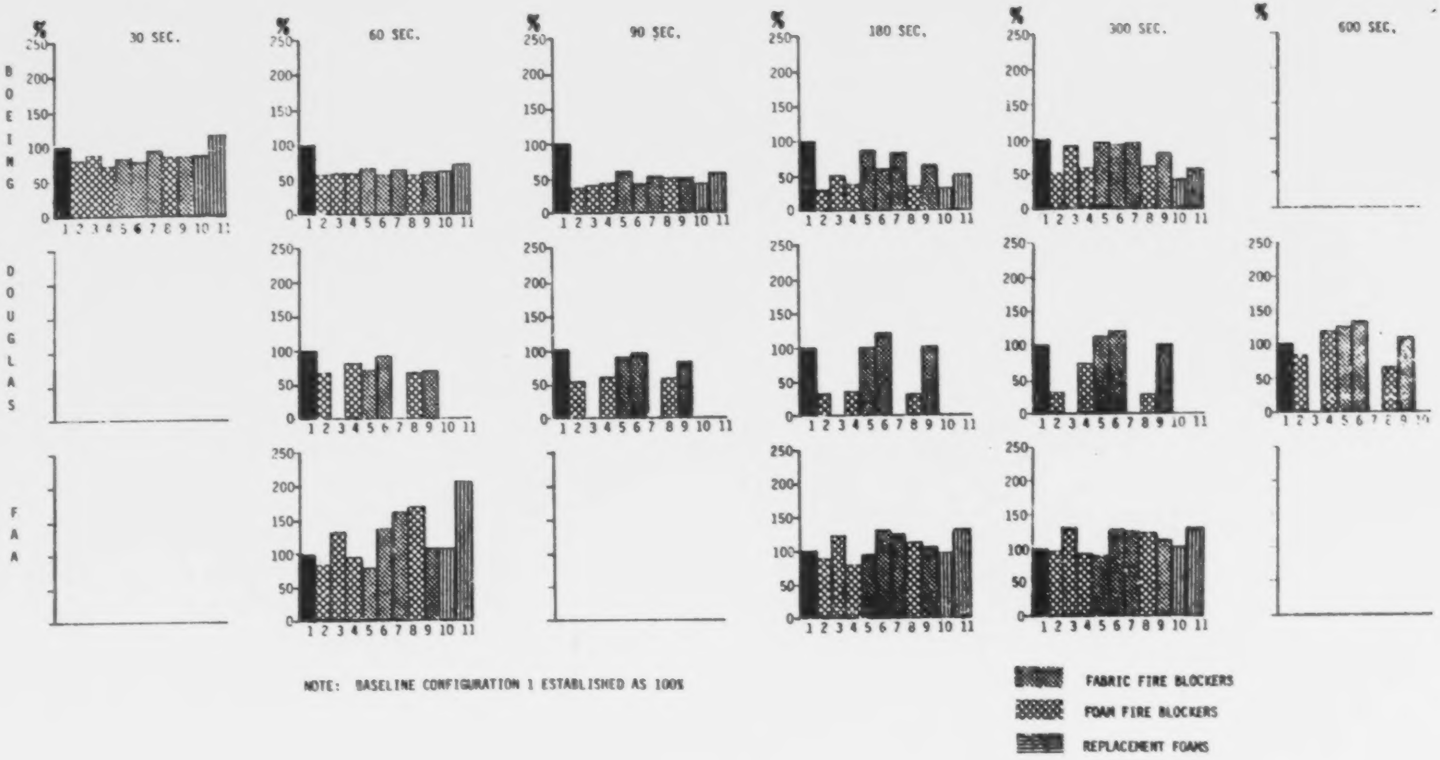
It should be noted that McDonnell-Douglas did not test configuration Nos. 3, 7, 10 and 11 and tested other configurations at only 2.5 W/cm^2 and 5.0 W/cm^2. Other blank charts on the figures occur because data were not reduced for all specific times by each participant. The absolute OSU data expressed in appropriate units are in Appendix 10.2.

First examination of the OSU heat release data in Figures 8 through 10 does not reveal a great deal of consistency of ranking between testing agencies. However, it must be remembered that a means is being sought for screening materials with relative level of fire resistance rather than ranking the eleven configurations in absolute order.

If it is assumed, as the FAA preliminary large scale tests indicate, that neoprene foam blocking layers provide one level of fire resistance, fire resistant fabrics a lower level of resistance and the replacement foams another level, then the configurations can be grouped and coded to demonstrate this. The Figures 8 through 13 have been coded to group configurations 2, 3, 4, and 8 as neoprene foam blocking layers, configurations 5, 6, 7 and 9 as fabric blocking layers and configurations 10 and 11 as replacement foams.

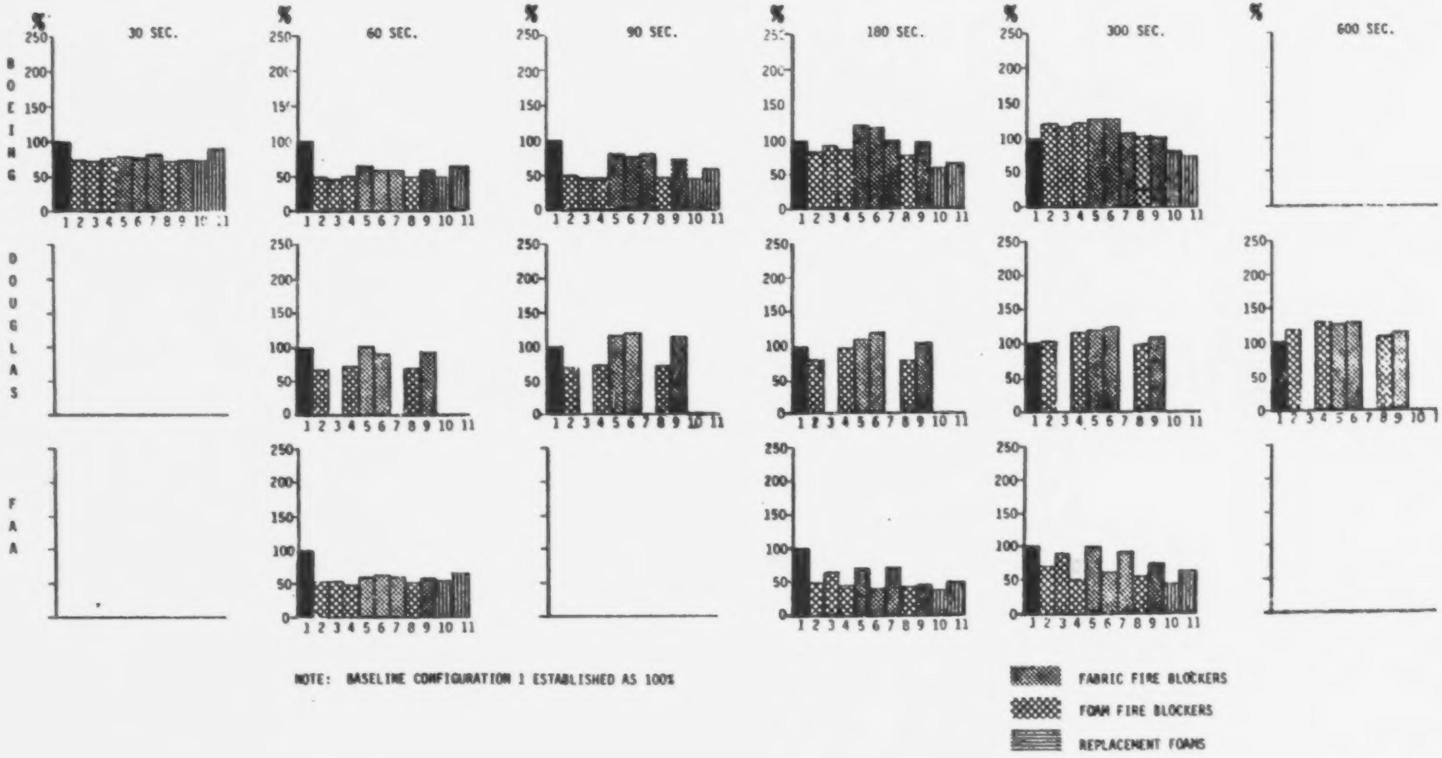
TABLE 7
OHIO STATE UNIVERSITY (OSU) RELEASE RATE CALORIMETER OPERATING PARAMETERS

	BOEING	DOUGLAS	FAA
SAMPLE SIZE	6" x 6" (15.2 cm x 15.2 cm)	10" x 10" (25.4 cm x 25.4 cm)	6" x 6" (15.2 cm x 15.2 cm)
RADIANT FLUX	2.5, 5.0 & 7.5 W/cm^2	2.5 & 5.0 W/cm^2	2.5, 5.0 & 7.5 W/cm^2
TYPE IGNITION	SAMPLE LOWER EDGE	SAMPLE LOWER EDGE	EVOLVED GASES
PRIMARY AIRFLOW	21 FT^3/MIN (0.01 m^3/SEC)	15 FT^3/MIN (0.0071 m^3/SEC)	21 FT^3/MIN (.01 m^3/SEC)
MIXING AIRFLOW	63 FT^3/MIN (0.03 m^3/SEC)	45 FT^3/MIN (0.021 m^3/SEC)	63 FT^3/MIN (.03 m^3/SEC)
THERMOPILE	COMPENSATED	UNCOMPENSATED	COMPENSATED



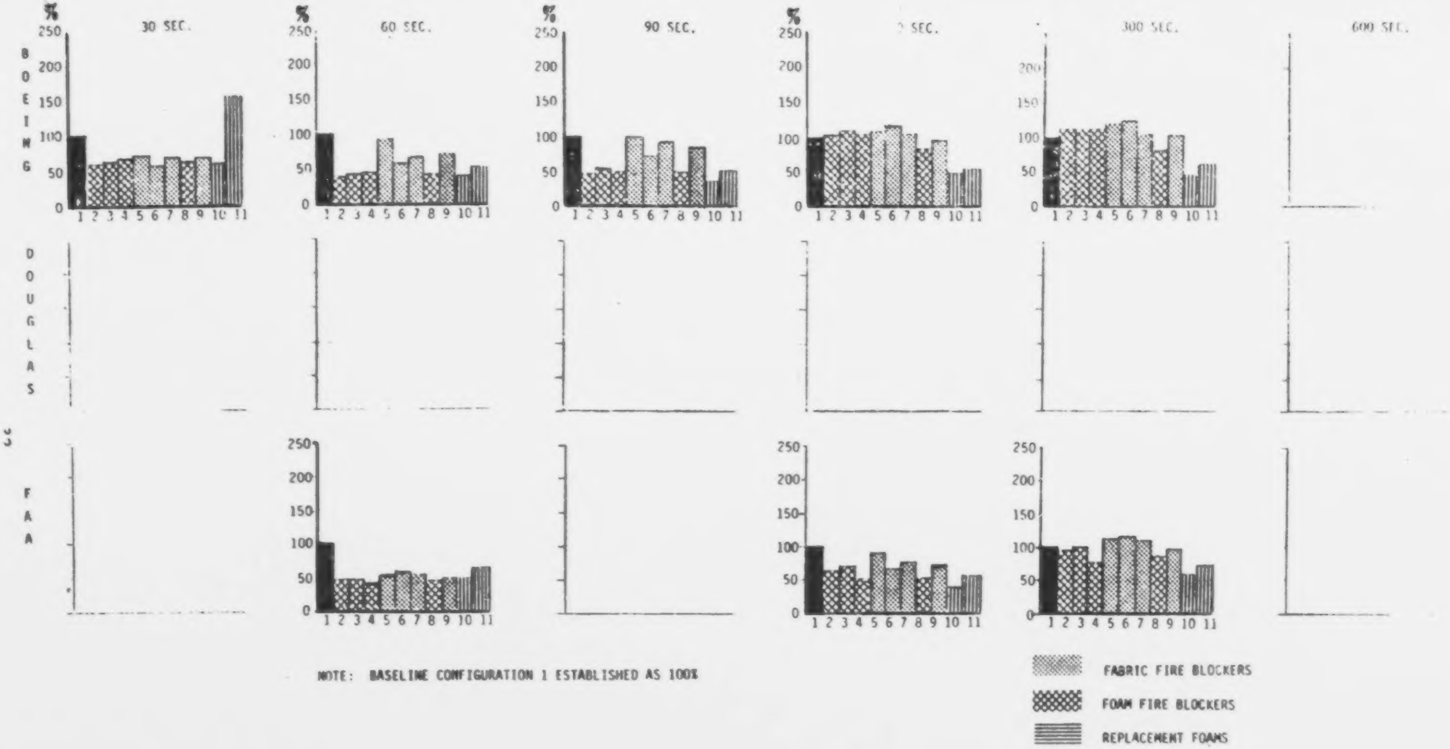
NOTE: BASELINE CONFIGURATION 1 ESTABLISHED AS 100%

FIGURE 8 COMPARISON OF OSU HEAT RELEASE AT 2.5 W/cm^2



NOTE: BASELINE CONFIGURATION 1 ESTABLISHED AS 100%

FIGURE 9 COMPARISON OF OSU HEAT RELEASE AT 5.0 W/cm^2



NOTE: BASELINE CONFIGURATION 1 ESTABLISHED AS 100%

FIGURE 10 COMPARISON OF OSU HEAT RELEASE AT 7.5 W/CM^2

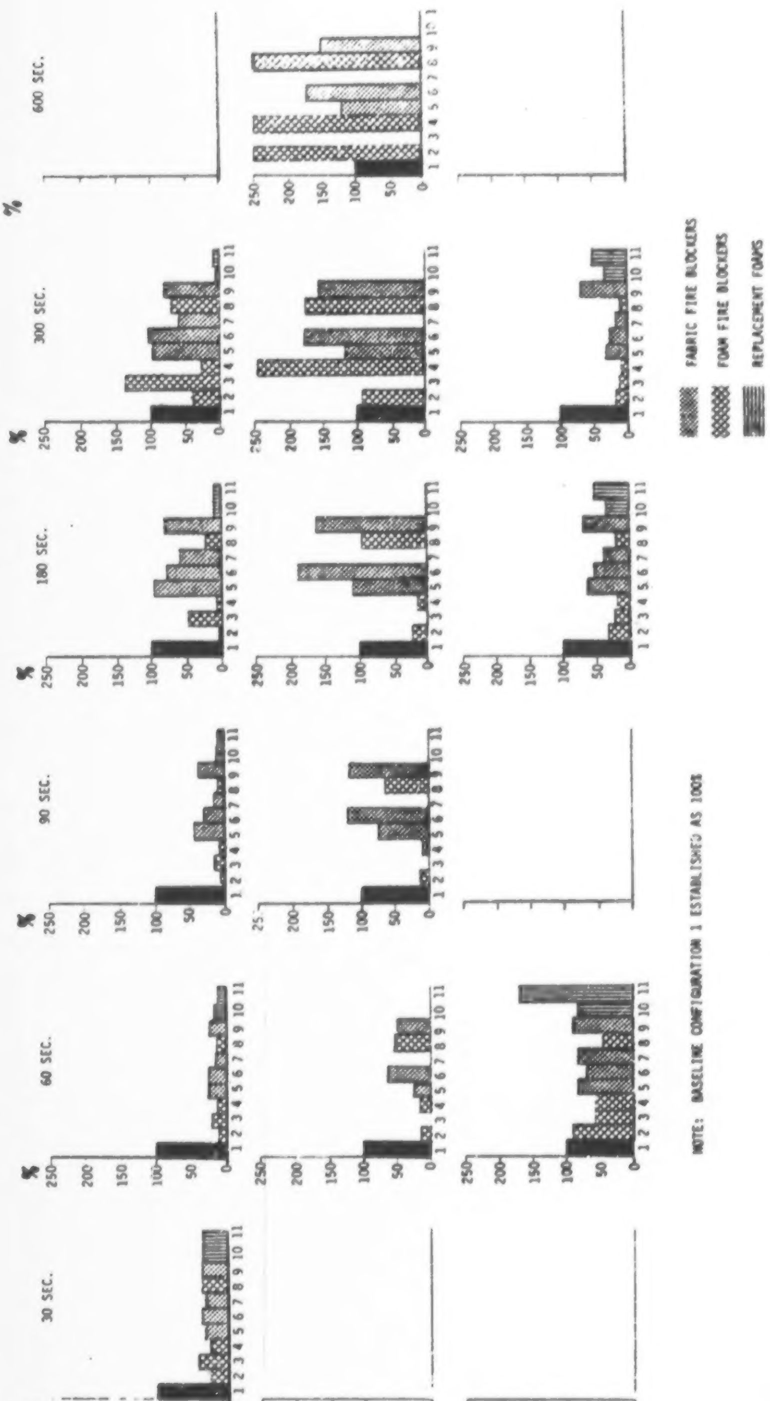
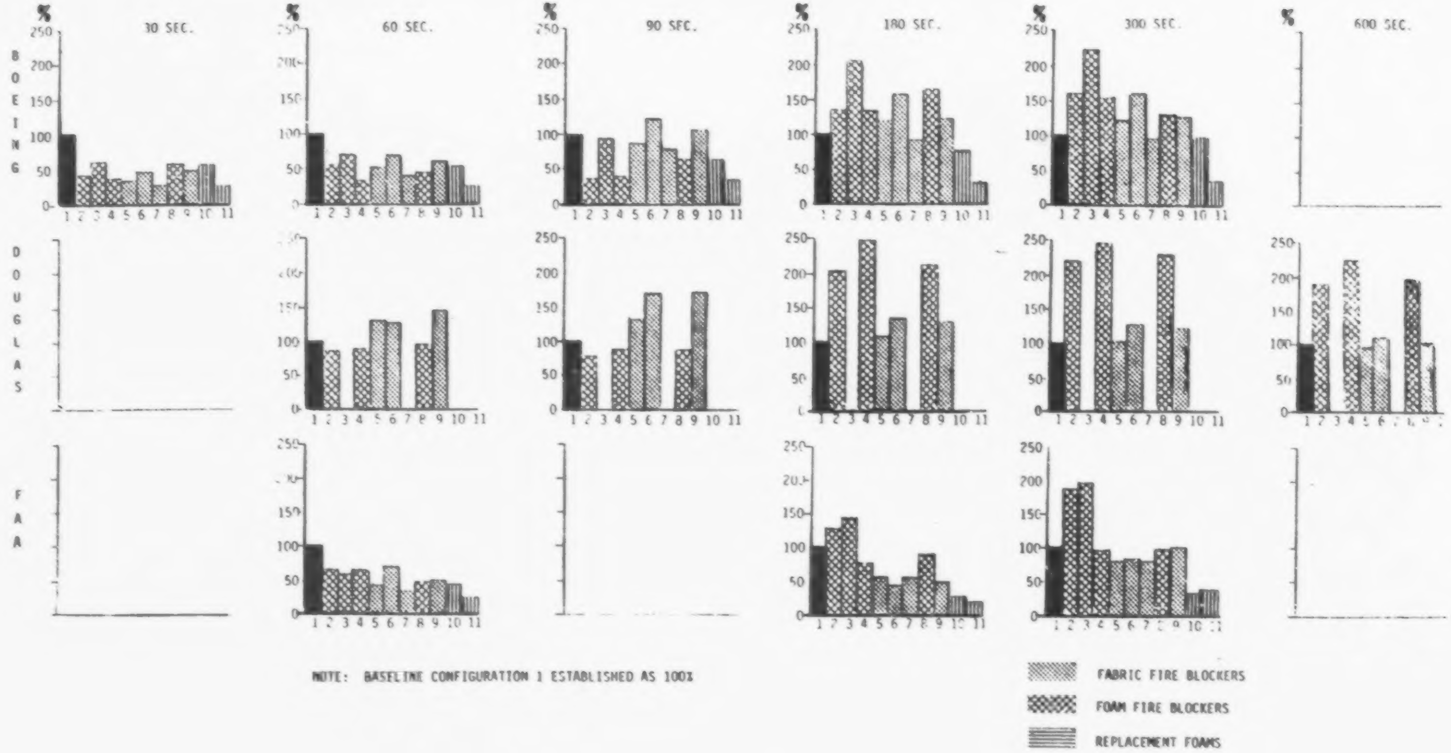
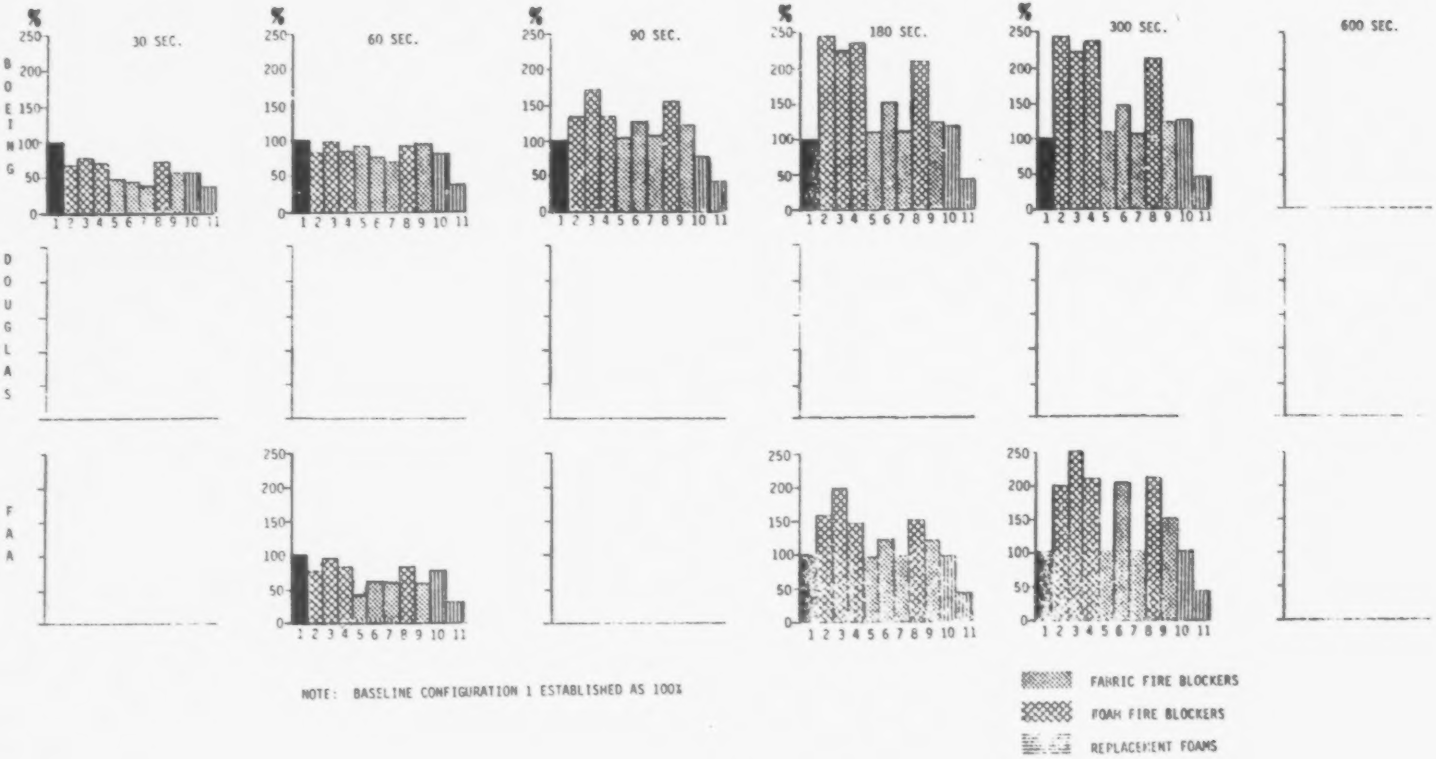


FIGURE 11 COMPARISON OF OSU SMOKE RELEASE AT 2.5 W/CM^2



NOTE: BASELINE CONFIGURATION 1 ESTABLISHED AS 100%

FIGURE 12 COMPARISON OF OSU SMOKE RELEASE AT 5.0 W/CM^2



NOTE: BASELINE CONFIGURATION 1 ESTABLISHED AS 100%

FIGURE 13 COMPARISON OF OSU SMOKE RELEASE AT 7.5 W/cm²

7.0 COMPARISON OF LABORATORY AND FULL SCALE FIRE TEST RESULTS

From the full scale fire tests conducted in the FAA C-133 fuselage (Reference 1) it appears that the fabric fire blocking layers tested are effective in preventing the spread of probable ramp and in-flight seat cushion fires.

A minimum amount of testing with simulated post-crash fires showed a [illegible] fire blocking layer beneficial in slowing the spread of fire, but less effective than the thicker and heavier neoprene foam fire blocking layer. These results are consistent with technical reasoning. Barring the use of metallic or other non-organic materials with high melting and burning temperatures, it is to be expected that the thicker non-porous materials would provide the better initial thermal protection for the urethane foam. These same materials could be less permeable to vaporized or liquified flammable foam products than the fabrics.

The photographic data of the closely controlled simulated-fire radiant heat tests conducted by McDonnell Douglas generally confirmed the results of the FAA full-scale, high-thermal-threat, post-crash fire tests. The weight loss data requires more than casual examination because each fire blocking layer added a unique weight increment to the baseline seat weight. Use of cushion foams other than urethane also resulted in changes in the specimen weight. Percent weight loss may be indicative of the extent of fire spread; however, total heat released is a parameter which cannot be ignored. Weight loss data is related to heat release only (1) if all material lost is burned and (2) if the heat of combustion for the material is known or if it can be assumed that all applicable materials have the same heat of combustion. Neither of these two points can be readily assumed for these experiments.

Generally, based on limited test data from each of several different fire threats, it may be said that the fabrics tested provide a significant level of fire blocking, the foam layers provide a greater level of protection and the replacement foams reduce the fire involvement to an even lower level. Examination of all the laboratory tests shows the same trend. The time to elevated foam temperatures in the T-3 burner exhibited the desired trend, although the data may have been difficult to interpret, and the method not applicable to evaluation of replacement cushion foam benefits.

The results of the mass injection rate experiments also predicted the large scale fire test results, and indicated the superiority of the foam blocking layer protection at high heating rates found in the post crash fire condition. The results at 5.0 W/cm^2 in the laboratory tests probably are most predictive of the overall protection offered by the blocking layers. Evaluation by only the specific mass injection rate assumes (as does evaluation by weight loss) that all material injected is combustible and has the same heat of combustion.

The Meeker burner tests gave the same performance trend when the amount of foam burned is examined and, in addition, confirmed some large scale test results (see 5.2 and reference 2) not predicted by other laboratory tests: viz, polyimide foam by itself is quite fire resistant, but when used with some upholstery materials will burn significantly more, resulting in increased heat release and fire spread.

The OSU heat release data gives the most quantitative data of all the laboratory tests. However, the variety of conditions employed by the round robin participants demonstrates the lack of standardization of the equipment and methods used in the aircraft field. It appears that the results of FAA and Boeing OSU tests taken at 5.0 W/cm^2

between 30 and 180 seconds test time correlates well with large scale test results. This time period and test flux also are representative of the values found important for those parameters in the full scale FAA-C133 post-crash tests. The protection given by the fire blocking layers is not so apparent in the Douglas OSU test results. However, good correlation to the FAA and Boeing data can be found if it is assumed that Douglas' recorded heat release for the baseline configuration is low. This assumption would lessen the relatively greater than expected heat release values of the fire-blocked configurations.

As an observation, much of the OSU smoke release data show the fire blocked configurations produce measurably more smoke than the baseline configuration, with the fabrics producing less than the neoprene foam layers. The increase in smoke is probably not significant when compared to the benefits from the decreased fire spread and lower heat release.

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

8.1.1 Full Scale Tests

The AIA Project 210-9 bases the following conclusions on the full scale fire test results:

1) Both the fabric and the foam fire blocking layers tested show significant and beneficial improvements in seat fire resistance for many ramp and in-flight fire conditions.

2) Both the fabric and the foam fire blocking layers tested show a measurable and beneficial delay and/or limitation in fire spread from simulated post-crash fire sources. In the more severe threats, neoprene foam blocking layers appear to offer more protection than do the fabrics tested.

3) The aluminized fabric tested reduced the seat foam involvement more than did the same fabric without the aluminum coating.

4) As replacements for aircraft seat cushioning foam both polyimide and LS-200 neoprene foams offer a high fire resistance. The former has not yet demonstrated satisfactory functional properties and use of the latter incurs an unreasonable weight penalty.

5) Fire-retardant urethane foam can be replaced with non fire-retardant urethane foam in aircraft seat cushions covered with a blocking layer material without loss in fire protection.

8.1.2 Comparison of Laboratory Test Data to Full Scale Test Results

The results of the laboratory fire tests and the comparison of laboratory and full scale data support the following conclusions.

1) Any one of the laboratory tests can screen fire blocking materials for retarding the burning of the polyurethane foam.

2) The Meeker burner test method indicates configuration-dependant characteristics not evident in other laboratory tests which constrain the entire boundary of the sample and expose it to uniform heating across the entire face.

3) The 181 E-glass fire blocking did show fire blocking performance similar to the aluminized fabric materials under the laboratory test conditions.

4) No laboratory test has had sufficient trial to establish a unique and acceptable fire blocking value for configuration selection.

8.2 Recommendations

The AIA TARC Project 210-9 makes the following recommendations for improving airplane seat fire resistance and for setting a standard for fire resistance control:

1) Airlines, airplane manufacturers, and seat manufacturers should develop seat cushions in airplanes that display as a minimum the fire resistance demonstrated by NORFAB® 11HT-26-AL (an aluminized fabric) used as a fire blocking layer on FAR 25.853b foam. To prevent seam splitting and barrier rupture from pressure of evolved gases, a pressure relief must be provided without destroying the fire blocking function.

2) Laboratory tests discussed in this report may be used as screening devices for fire blocking layers or for fire resistant seat cushions.

3) Full scale fire testing of E-181 glass fabric should be conducted by the FAA in an attempt to confirm its use as a readily available and consistent fire blocking layer standard for minimum fire resistance .

4) A fire test on simulated full size seat cushions (bottom and back) including venting should be conducted to confirm the fire resistance of a selected configuration. The radiant heat/propane ignition test set up used by McDonnell Douglas as reported herein has been found adequate. A 2 gallon per hour oil burner test developed by the FAA Technical Center will be evaluated by industry.

   The degree of seat destruction, foam consumption and fire spread as compared to the NORFAB® 11 HT-26-AL wrapped cushion (or E 181 glass fabric, if confirmed acceptable) should be a subjective criteria for acceptability.

   Quality Control of seat construction components other than the fire blocking materials should be by current FAR 25.853 test methods. A QC test method for blocking materials must be developed.

5) Although demonstrating a high fire resistance, neither polyimide nor LS-200 neoprene foam is recommended as a replacement for urethane foam in aircraft seat cushioning.

9.0 REFERENCES

1. Hill, R. G. and Sarkos, C. P., "Effectiveness of Seat Cushion Blocking Layer Materials Against Cabin Fires". FAA Technical Center presentation at 1982 SAE Aerospace Congress and Exposition, October 25-28, 1982 at Anaheim, California.

2. Duskin, Fred E. and Schutter, Kenneth J., "Study for the Optimization of Aircraft Seat Cushion Fire-Blocking Layers - Full Scale - Test Description and Results", McDonnell Douglas Corporation, Final Report for Contract NASA 2-11095, May 1982.

3. Kourtides, D. A., Parker, J. A., Ling, A. C., and Hovatter, W. R., "Optimization of Aircraft Seat Cushion Fire Blocking Layers", U. S. Department of Transportation Final Report No. DOT/FAA/CT-82-132 (July 1982).

4. American Society for Testing Materials, ASTM Committee E-5 on Fire Standards, Working Paper titled "Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products" currently in committee review.

10.0 APPENDICES

10.1 Industry and Government Correspondence

AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC

1725 DE SALES STREET N W WASHINGTON D C 20036 TEL 347-2315

August 7, 1981

Mr. Jerry M. Chavkin
Chief, Aircraft Engineering Division, AWS-100
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D. C. 20591

Mr. Roy E. Reichenbach
Chief, Aircraft Safety Development Division, ACT-300
Federal Aviation Administration Technical Center
Atlantic City Airport, New Jersey 08405

Subject: Improved Fire Resistant Aircraft Seat Cushions

Gentlemen:

In November 1980, AIA formed Project 210-9 within the Transport Airworthiness Requirements Committee (TARC) to study the implementation of requirements for improved fire resistant seat cushions for airplanes. Eventual project objectives include definition for AIA members of the following:

1) Current cushion functional characteristics

2) Functional performance guidelines for new cushions

3) Current cushion fire performance

4) Guidelines for improved fire performance within the capability of available materials meeting functional guidelines

The early approach to the objectives included a review of current programs (government and industry) relating to improved cushion fire resistance. To this end, AIA representatives met with FAA Technical Center personnel January 14, 1981 to discuss the large scale fire test program underway there. Also, AIA technical representatives attended a February 10-11, 1981, NASA-sponsored meeting reporting the status of the several NASA-funded development projects for fire resistant seat cushions and an up-date of the FAA Technical Center progress. The TARC Project contacted seat manufacturers and others associated with cushion development. Based on this review, AIA offers the following comments on current status:

(1) Extensive laboratory and full scale testing has narrowed the list of available materials that could be employed to improve the fire resistance of passenger seats of conventional design. Since the density of neoprene is unacceptable and polyimide is not yet developed, polyurethane is the only available cushion material. Fire blocking elements may be Vonar, LS-200 neoprene, Kermel or PBI batting in combination with various fabric layers such as Nomex, PBI (if available) or other suitable fire resistant materials.

(2) A protective blocking layer on the surface of the urethane foam will add substantial weight and labor cost to the seat. The blocking materials are presently available but their optimum configuration for fabricability is not established. Commercial fabrication capability must be established. Once a given blocking construction is established, there will still be a substantial (6 months to a year) lag before installation of such seats could be initiated in aircraft.

(3) The extensive testing of seat cushion configurations and interior lining against several fire sources in the C-133 fuselage at FAA-ACT has yielded voluminous data supporting fire safety benefits from possible changes in seat cushion configuration. However, test condition decisions, test plans, baseline calibration data for the tests, method of test data analysis, and results have not been documented.

(4) The feasibility of one seat cushion fire blocking concept has been demonstrated by limited service tests. An FAA-sponsored optimization program is underway to minimize the impact (wieght) on airplane performance for a similar concept.

(5) FAA planning to establish small scale and/or laboratory tests for certification (regulations) and quality control should be established.

(6) The larger AIA member companies (Lockheed, Boeing, and McDonnell Douglas) are participating in seat cushion and fire test methods development with independent studies.

The AIA wishes to continue use of the best available fire resistant materials in aircraft cabins within reasonable economic and fabrication constraints. The AIA is in full support of a passenger seat cushion fire blocking development program. However, the AIA does have some concerns about the FAA test and development program and wish to address these:

(1) The AIA agrees that seat cushion contribution to cabin fires and the degree of improvement possible within the state of the art must be confirmed by large scale fire tests. The FAA C-133 fire test facility at the Technical Center is the best available instrument to establish these important performance properties quantitatively to maintain program perspective. The AIA recognizes that the current test configuration (large fuselage opening, large fire, minimum fire source entry) was selected to obtain maximum specimen exposure to heat with minimum combustion products from the source to interfere with evaluation of the specimen behavior. However, this condition, while possible, certainly is not typical of post-crash fire incidents in past fatal accidents. The use of only this scenario to evaluate the possible reduction in post crash fire hazard with interior material changes may be misleading. For instance, as the Technical Center has experienced, decreasing the size of the fuselage simulated "rupture" can reduce the effect of seat cushion involvement while increasing significantly the hazard contribution of the fire source.

To obtain a proper perspective of interior material post-crash fire contribution, the AIA recommends that the FAA examine again the accident statistics for past survivable post-crash fire scenarios. With an inert fuselage interior, several scenarios could be tested to determine the threat to interior materials and the life hazard contribution by the fire source. The results obtained from the specific material tests then could be evaluated in light of the likelihood for such a fire condition.

(2) The AIA understands the desire of the FAA to show feasibility for the fire blocking concept by development of a configuration "optimized" for minimum weight, cost, etc. using state of the art materials. However, in the short FAA program it is not possible to evaluate all aspects of design and fabrication. Improvements in passenger seat fire safety standards must not be accomplished by the mandating of particular materials or design. It is recommended that the FAA emphasize the development of small scale and laboratory test methods and standards for seat cushion certification and to assure quality control of configuration and materials employed. The AIA believes the ultimate solution for improved seat cushion fire resistance lies in development of new cushioning concepts eliminating, most certainly, polyurethane foam and possibly all foams. A standard mandating particular materials and design would stifle this development.

The AIA recognizes the time constraints placed upon the FAA Technical Center program and the limitations of the FAA budget and technical staff; however, the impact of a mandated standard configuration could be difficult to justify. The AIA urges the FAA to reconsider the current program emphasis and to consider alternatives possible with coordinated FAA and AIA technical expertise. These alternatives should include reconsideration of the current C-133 design fire condition and the establishment of a plan for development of new fireworthiness criteria and standards for seat cushions.

Very truly yours,

AEROSPACE TECHNICAL COUNCIL

J. P. Reese - Director
Airworthiness Programs
for

U.S. Department of Transportation
Federal Aviation Administration

800 Independence Ave., S.W.
Washington, D.C. 20591

October 16, 1981

Mr. J. P. Reese
Director, Airworthiness Programs
Aerospace Industries Association
  of America, Inc.
1725 De Sales Street, NW.
Washington, D.C. 20036

Dear ~~Mr. Reese~~ Jack:

This is in reply to your letter of August 7 to this office and to Mr. Roy Reichenbach of the Technical Center, regarding the research and development program for improved fire resistant seat cushions. Mr. Reichenbach, the co-addressee, will reply to your letter separately on those particular program aspects of concern to the Technical Center.

Your expression of support of the program is most welcome. Your comments on page 2 largely reflect our understanding of the program as it stands today. We take some exception to your items 1 and 2. Fire blocking materials may not necessarily be limited to those you have mentioned and they may not increase the weight of the cushion. We are working toward publication of the information mentioned in item 3.

We fully appreciate your concerns with the technical areas discussed on page 3. Considering the advancements which have been made in the program to date, we believe your concerns are being taken into consideration, and that the program will progress to a satisfactory resolution of these issues. On August 25 and 26, subsequent to your letter, an informal meeting was held at the Technical Center with several representatives of the Federal Aviation Administration, the National Aeronautics and Space Administration (NASA), and industry to review the major technical aspects of the research and development work. It was the consensus of that meeting that the evaluation of improved fire resistant cushions should be based on credible fire scenarios, as you have suggested. Work is continuing on the investigation of fire scenarios.

We agree with you that criteria for a cushion should be based on performance rather than on the specification of a particular material or design. Performance criteria which fosters design innovation can promote both the use of fire blocking construction for polyurethane foam and the use of advanced foam materials such as polyimide, and thus give the designer an opportunity to optimize the materials and the cushion design. We are working currently with the NASA and several aircraft manufacturers on the evaluation of a small scale test which will be suitable as a basis for performance criteria. A round-robin test series is being conducted which we hope will guide us in this area.

as the program progresses and you become more familiar with the [illegible] you will find the objectives of the program more to your [illegible] te you and your member companies to inquire informally at [illegible] Technical Center at your convenience regarding the [illegible] status of the program.

Sincerely,

Jerry

Jerry Chavkin
Chief, Aircraft Engineering Division
Office of Airworthiness

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
TECHNICAL CENTER
ATLANTIC CITY AIRPORT, NEW JERSEY 08405

DEC 2 1981

Mr. J. P. Reese
Director, Airworthiness Programs
Aerospace Industries Association of America, Inc.
1725 De Sales Street, NW
Washington, DC 20036

Dear Mr. Reese:

This letter is in reply to your letter of August 7, 1981, to this office and to Mr. Jerry Chavkin, of the Office of Airworthiness, regarding the evaluation of seat cushion fire blocking layer materials for fire safety effectiveness. Mr. Chavkin has responded to those aspects of your letter which concern his organization.

We appreciate your appraisal of the C-133 test article as the best available instrument to establish the performance improvement of aircraft seats protected with cushion fire blocking layer materials. We have gathered the majority of the C-133 data, with the primary seat centered at a large fuselage opening adjacent to an external fuel fire. The rationale and test observations behind the selection of a large opening was described in a March 31 letter to Mr. Everett Tustin, Chairman of the Transport Airworthiness Requirements Committee (TARC) on Fire Resistance Seat Cushions. Briefly, as stated in this letter, a large opening provides for better discrimination between the performance of candidate blocking layer materials than does a smaller opening. Because of our very limited supply of cabin lining materials, at this late state of our program we cannot comprehensively evaluate blocking materials at other postcrash fire scenarios, with the aim of calculating potential safety benefit, by factoring in the "likelihood for such a fire condition." Besides, the likelihood or probability of a given aircraft crash fire scenario, to our knowledge, is currently unknown. Your letter is pointing to the need for an analysis of the reduction in fire risk in aircraft accidents as the result of using a seat cushion blocking layer. In this regard, we plan to initiate research this fiscal year to develop a model to deal with risk abatement associated with blocking layers, and later with other cabin fire safety strategies.

With the large opening fire scenario, full-scale tests with the remaining cabin materials in place demonstrated that the application of a commercial foam fire blocking layer would provide approximately 50 seconds improvement in safety. In recent months, we have expanded our scenario studies, not to the extent that you recommended, but to include ramp and in-flight fires, as well as a postcrash fire adjacent to a door opening. The improvements are even more impressive; for example, using realistic ramp and in-flight fire ignition sources, we can prevent the occurrence of a self-sustaining cabin fire by using a cushion blocking layer.

On page 2 of your letter, you indicate that C-133 test results have not been documented. In this regard, our current plan is for a draft report in January 1982, and a published report in April or May 1982. A similar report date is planned for the FAA-sponsored optimization work at NASA Ames (item 4, page 2).

We share your concern that blocking layer materials should be selected based on a small-scale/laboratory test, not through the mandating of particular materials or design. Subsequent to your letter a working meeting was held at the Technical Center with representatives from FAA, NASA, and industry who agreed to participate in a round-robin test series to evaluate existing test procedures. The cooperation expressed by the parties involved was, I believe, unprecedented in a matter of this kind. A round-robin study is necessary to develop suitable test procedures for materials selection. Although it has been time consuming to secure ample quantities of the 11 material configurations agreed upon at the meeting, we expect these materials to have been delivered during November to the participating laboratories. Testing should be completed by February 1982, and a working meeting will follow as quickly as the data can be tabulated and analyzed.

We appreciate your interest and comments on our seat cushion fire blocking layer test program. If we can be of further assistance, please feel free to contact us at any time.

Sincerely,

R. E. Reichenbach
Chief, Aircraft Safety Development
Division

SUMMARY OSU EVALUATION **AGENCY:** BOEING

HEATING RATE: 2.5 W/cm^2 **CHARACTERISTIC:** HEAT

CONFIG. NO.	Q - J/cm^2					MAX dQ/dt - W/cm^2	
	30 sec.	60 sec.	90 sec.	180 sec.	300 sec.	dQ/dt	Time - Sec.
1	263.	753.	1235	1898	2107	17.75 17.57	50 90
2	221.	411.	469	622	1133	13.67 5.65	25 270
3	231.	425.	524	955	1895	13.34 8.90	25 275
4	192.	420.	531	787	1241	14.29 4.81	25 300
5	215.	475.	714	1607	1977	12.56 10.81	25 150
6	205.	407.	539	1279	1956	12.32 10.27	25 205
7	243.	467.	638	1546	1983	13.78 11.99	20 155
8	224.	408.	463	745	1274	12.81 5.40	25 205
9	224.	429.	626	1338	1736	13.78 8.38	25 140
10	232.	447.	539	698	929	13.27	25
11	306.	536.	704	1005	1243	17.84	20

SUMMARY CSU EVALUATION **AGENCY:** DOUGLAS

HEATING RATE: 2.5 W/cm^2 **CHARACTERISTIC:** HEAT

CONFIG NO.	Q - KW-MIN/m^2					MAX. dQ/dt - KW/m^2	
	60 sec.	90 sec.	180 sec.	300 sec.	600 sec.	dQ/dt	Time - sec.
1	25.2	53.9	104.4	141	160	83 35	59 150
2	17.3	28.1	35.7	47	135	37.5 27.5	55 300
3	-	-	-	-	-	-	-
4	21.5	32.0	38.2	105	188	42.5 43.0	50 231
5	19.1	46.2	105.8	161	202	62.2 40.0	84 200
6	23.2	49.6	126.0	172	213	47 70.1	55 92
7	-	-	-	-	-	-	-
8	17.9	28.9	35.3	41	109	39.2 22.5	51 300
9	18.8	41.9	106.8	145	177	42.0 54.1	58 109
10	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-

SUMMARY OSU EVALUATION AGENCY: FAA-ACT

HEATING RATE: 2.5 W/cm^2 CHARACTERISTIC: HEAT

CONFIG. NO.	Q - J/cm^2					MAX dQ/dt ; W/cm^2	
	30 sec.	60 sec.	90 sec.	180 sec.	300 sec.	dQ/dt	Time - sec.
1		13		54	109	.68	204
2		11		48	104	.63	236
3		17		66	143	.81	258
4		12		42	101	.81	260
5		10		50	99	.60	155
6		18		70	138	.95	227
7		21		68	136	.99	207
8		22		61	135	1.07	259
9		14		58	122	.99	211
10		14		52	114	.99	259
11		27		71	143	1.01	261

SUMMARY OSU EVALUATION AGENCY: BOEING

HEATING RATE: 5.0 W/cm^2 CHARACTERISTIC: HEAT

CONFIG. NO.	Q - J/cm^2					MAX dQ/dt - W/cm^2	
	30 sec.	60 sec.	90 sec.	180 sec.	300 sec.	dQ/dt	Time - sec.
1	499.	1219.	1541	1806	1930	21.59 26.38	10 35
2	355.	562.	733	1513	2326	18.19 12.04	10 150
3	347.	551.	724	1691	2273	18.24 13.32	10 125
4	378.	578.	730	1550	2325	20.55 13.75	10 160
5	390.	773.	1237	2214	2450	17.74 18.45	10 95
6	379.	700.	1192	2161	2446	21.23 18.17	10 110
7	393.	694.	1231	1834	2069	20.24 20.18	10 80
8	347.	567.	742	1419	1991	18.52 8.53	10 120
9	352.	644.	1108	1732	1975	18.73 16.73	15 80
10	354.	557.	712	1104	1546	18.71	10
11	450.	744.	942	1168	1387	26.69	10

SUMMARY OSU EVALUATION

HEATING RATE: 5.0 W/cm^2

AGENCY: DOUGLAS

CHARACTERISTIC: HEAT

CONFIG NO.	Q - KW-MIN/m^2					MAX. dQ/dt - KW/m^2	
	60 sec.	90 sec.	180 sec.	300 sec.	600 sec.	dQ/dt	Time - sec.
1	51.1	68.2	117.7	139	151	75 40	36 120
2	34.6	46.1	97.2	141	182	55 50	22 125
3	-	-	-	-	-	-	-
4	36	49	114	162	201	59 62	17 115
5	51.9	80.7	132.7	165	197	57 79	25 57
6	46.3	81.9	141	175	200	58 77	25 68
7	-	-	-	-	-	-	-
8	35.4	47.8	96.0	132	164	58 47	22 125
9	47	80	127	155	174	55 72	25 66
10	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-

SUMMARY OSU EVALUATION AGENCY: FAA-ACT

HEATING RATE: 5,0 W/cm^2 CHARACTERISTIC: HEAT

CONFIG. NO.	Q - J/cm^2					MAX dQ/dt - W/cm^2	
	30 sec.	60 sec.	90 sec.	180 sec.	300 sec.	dQ/dt	Time - sec.
1		640		1542	1901	16.78	44
2		337		761	1273	15.16	23
3		341		993	1632	15.51	24
4		315		646	932	15.09	24
5		381		1055	1878	13.75	23
6		393		639	1102	14.30	24
7		383		1094	1735	14.80	24
8		339		695	1023	14.95	24
9		356		715	1362	14.88	25
10		346		628	832	15.30	23
11		410		808	1198	17.49	21

SUMMARY OSU EVALUATION

HEATING RATE: 7.5 W/cm^2

AGENCY: BOEING

CHARACTERISTIC: HEAT

CONFIG. NO.	Q - J/cm^2					MAX dQ/dt - W/cm^2	
	30 sec.	60 sec.	90 sec.	180 sec.	300 sec.	dQ/dt	Time - sec.
1	617.	1178.	1364	1556	1673	27.00 24.98	7 25
2	357.	524.	681	1618	1859	21.35 15.53	5 130
3	364.	547.	938	1710	1865	22.03 16.73	5 75
4	388.	549.	733	1653	1864	24.53 16.74	5 105
5	442.	1061.	1437	1729	1945	20.41 22.24	5 45
6	351.	682.	1110	1827	2013	15.06 18.91	20 95
7	406.	795.	1308	1654	1748	21.66 19.53	5 75
8	351.	496.	703	1223	1345	20.00 8.75	5 95
9	404.	848.	1215	1506	1700	22.89 18.00	5 55
10	342.	471.	556	/18	768	20.82	10
11	954.	677.	773	887	986	31.49	5

SUMMARY OSU EVALUATION AGENCY: FAA-ACT
HEATING RATE: 7.5 W/cm^2 CHARACTERISTIC: HEAT

CONFIG. NO.	Q - J/cm^2					MAX dQ/dt - W/cm^2	
	30 sec.	60 sec.	90 sec.	180 sec.	300 sec.	dQ/dt	Time - sec.
1		837		1802	2042	20.79	48
2		409		1173	1880	16.90	15
3		408		1314	2036	17.69	18
4		379		967	1621	15.44	17
5		433		1632	2304	14.66	17
6		450		1247	2350	16.28	15
7		447		1487	2231	16.28	16
8		405		1040	1786	15.93	18
9		422		1349	1981	15.58	16
10		416		827	1187	17.02	17
11		486		1065	1437	21.08	15

SUMMARY OSU EVALUATION AGENCY: BOEING

HEATING RATE: 2.5 W/cm^2 CHARACTERISTIC: SMOKE

CONFIG. NO.	D_s					MAX dD_s/dt	
	30 sec.	60 sec.	90 sec.	180 sec.	300 sec.	dD_s/dt	Time - sec.
1	20.	95.	122	147	147	2.92 1.23	40 80
2	5.	8.	8	8	59	.59 .75	30 240
3	8.	16.	20	73	203	.86 1.47	30 205
4	5.	9.	10	11	47	.52 .88	30 205
5	6.	23.	52	141	146	1.50 1.14	80 150
6	7.	23.	34	116	154	1.06 1.33	30 120
7	6.	12.	20	88	102	.55 .99	25 150
8	7.	11.	11	33	106	.63 .78	30 175
9	7.	20.	46	117	124	1.24 .87	115 140
10	7.	15.	15	15	16	.67	30
11	7.	10.	13	15	17	.66	25

SUMMARY OSU EVALUATION **AGENCY:** DOUGLAS

HEATING RATE: 2.5 W/cm^2 **CHARACTERISTIC:** SMOKE

CONFIG. NO.	INTEGRATED SMOKE RELEASE - SMOKE					MAX SMOKE RELEASE RATE	
	60 sec.	90 sec.	180 sec.	300 sec.	600 sec.	Smoke/m^2	Time - sec.
1	10.3	13.6	21.1	23.3	25.4	39.4 7	52 150
2	1.4	2.1	4.7	21.9	73.9	53.3	302
3	-	-	-	-	-	-	-
4	1.5	1.7	2.7	56.7	69.4	4 41.8	45 223
5	2.7	10.9	23.1	27.5	30.6	27.7	87
6	6.6	16.7	39.8	41.3	42.8	21 31.4	55 81
7	-	-	-	-	-	-	-
8	5.7	9.2	19.5	40.8	96.1	9 47.2	45 302
9	5.2	16.0	35.4	36.5	38.1	18 28.9	60 85
10	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-

SUMMARY OSU EVALUATION | AGENCY: FAA-ACT

HEATING RATE: 2.5 W/cm^2 | CHARACTERISTIC: SMOKE

CONFIG. NO.	D_s					MAX dD_s/dt	
	30 sec.	60 sec.	90 sec.	180 sec.	300 sec.	dD_s/dt	Time - sec.
1		9		49	96	.97	156
2		8		16	18	.29	44
3		5		12	12	.26	52
4		5		10	10	.19	40
5		7		30	30	.68	72
6		6		26	26	.46	72
7		7		19	19	.29	50
8		4		11	11	.23	42
9		8		32	32	.46	56
10		7		17	17	.32	52
11		15		25	25	.71	50

SUMMARY OSU EVALUATION

HEATING RATE: 5.0 W/cm^2

AGENCY: BOEING

CHARACTERISTIC: SMOKE

CONFIG. NO.	D_s					MAX dD_s/dt	
	30 sec.	60 sec.	90 sec.	180 sec.	300 sec.	dD_s/dt	Time - sec.
1	71.	122.	130	133	134	3.20 3.47	15 25
2	30.	68.	50	184	215	2.05 2.28	20 150
3	45.	84.	121	274	295	2.67 2.50	20 120
4	26.	43.	51	178	207	1.56 2.51	20 140
5	24.	65.	113	159	161	1.63 2.07	20 60
6	33.	84.	156	212	215	2.51 2.73	20 65
7	21.	51.	104	114	120	1.18 2.07	15 80
8	41.	59.	82	220	244	2.46 2.15	15 110
9	35.	75.	138	167	174	2.20 2.47	20 80
10	41.	68.	80	104	131	2.44	20
11	20.	35.	45	47.	48	1.53	15

SUMMARY OSU EVALUATION **AGENCY:** DOUGLAS

HEATING RATE: 5.0 W/cm^2 **CHARACTERISTIC:** SMOKE

CONFIG. NO.	INTEGRATED SMOKE RELEASE - SMOKE					MAX SMOKE RELEASE RATE	
	60 sec.	90 sec.	180 sec.	300 sec.	600 sec.	Smoke/m^2	Time - Sec.
1	23.1	28.3	40.9	44.4	53.2	57 15	22 100
2	19.8	22.32	83.9	97.2	99.7	53 84.4	25 121
3	-	-	-	-	-	-	-
4	20	24	102	114	118	44 109	20 112
5	29.3	37.1	44.5	45.0	46.8	53.3	30
6	28.9	46.8	55.6	56.5	59.5	56 58.2	30 65
7	-	-	-	-	-	-	-
8	21.4	24.1	86.4	100.9	103.4	53 85.3	26 125
9	34	48	54	54	55	65 49	24 55
10	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-

SUMMARY OSU EVALUATION **AGENCY:** FAA-ACT

HEATING RATE: 5.0 W/cm^2 **CHARACTERISTIC:** SMOKE

CONFIG. NO.	D_s					MAX dD_s/dt	
	30 sec.	60 sec.	90 sec.	180 sec.	300 sec.	dD_s/dt	Time - sec.
1		62		93	93	2.53	24
2		35		117	172	2.40	22
3		33		142	190	2.24	22
4		35		69	86	1.36	22
5		24		49	72	1.13	24
6		37		39	75	1.87	28
7		20		50	74	.74	30
8		27		82	87	2.01	24
9		29		46	88	1.78	28
10		26		28	28	1.23	24
11		14		19	33	1.04	16

SUMMARY OSU EVALUATION

HEATING RATE: 7.5 W/cm^2

AGENCY: BOEING

CHARACTERISTIC: SMOKE

CONFIG. NO.	D_s					MAX $d^{D}s/dt$	
	30 sec.	60 sec.	90 sec.	180 sec.	300 sec.	$d^{D}s/dt$	Time - sec
1	98.	141.	142	143	144	4.75 5.00	15 25
2	66.	121.	192	352	354	3.20 3.66	15 100
3	78.	145.	246	329	331	4.39 4.12	10 80
4	68.	122.	192	340	349	3.13 4.06	10 100
5	45.	129.	149	155	161	1.70 3.61	10 40
6	43.	117.	181	216	216	2.69 2.30	25 90
7	38.	104.	153	158	158	2.94 2.51	40 65
8	71.	132.	220	303	309	3.84 3.30	15 80
9	56.	143.	174	178	182	3.22 3.46	15 40
10	56.	90.	112	168	188	3.31	15
11	36.	56.	58	62	68	2.62	10

SUMMARY OSU EVALUATION AGENCY: FAA-ACT

HEATING RATE: 7.5 W/cm^2 CHARACTERISTIC: SMOKE

CONFIG. NO.	D_s					MAX dD_s/dt	
	30 sec.	60 sec.	90 sec.	180 sec.	300 sec.	dD_s/dt	Time - sec.
1		80		106	106	3.20	18
2		60		164	209	2.69	16
3		74		206	263	2.97	16
4		63		152	221	2.21	18
5		30		94	108	1.54	18
6		48		126	215	2.33	18
7		47		95	110	1.13	26
8		63		159	222	2.53	18
9		47		124	159	2.72	18
10		61		95	110	2.08	18
11		22		41	45	1.43	12

Air Transport Division

Local 553
TRANSPORT WORKERS UNION
OF AMERICA, AFL-CIO

Airport Plaza · Suite 412 • 7370 N.W. 36th Street • Miami, Florida 33166
Telephone (305) 592-9390

Patricia Fink
President
Jeanne Helene Notaro
First Vice President
Judy Caldwell
Financial Sec'ty Treas

July 22, 1983

Mr. John P. O'Hara
Staff Director and Council
Subcommittee on Investigation and Oversight
Committee on Public Works and Transportation
B-376 Rayburn House Office Building
Washington, D. C. 20515

Dear Mr. O'Hara:

After attending the Hearings on Aircraft Passenger Survivability, I would like to make these suggestions and observations:

1. There should be protective breathing equipment for the flight attendant crew, so that they can continue to fight the fire in a toxic environment and perform their evacuation duties. I requested that one "Scott Hood" (approx. cost $ 200.00) be placed in the 1011 lower lobe galley after a flight attendant had to fight two fires down there. I was informed by management that the cost to put one smoke hood on each aircraft was too great until the size of our fleet was reduced, when we parked the majority in the desert. To date, we have no smoke hoods in our 1011 galleys.

2. Emergency lighting should be lowered to arm rest or floor level. Three years ago, when I attended a Cami cabin safety workshop, I saw a demonstration of how effective lowered emergency lighting was in a smoke filled cabin. It's nice to know, finally, that the F.A.A. is getting ready to put out an NPRM on this.

3. Methods should be developed (such as joint recurrent training) to increase communication between pilots and flight attendants. The Seattle accident is an example where the flight attendant informed the captain that the cabin and passengers were prepared for the emergency landing, and the captain continued to inquire about the condition of the cabin. The "O" ring incident is another. The captain did not tell the senior flight attendant how much time they had to prepare for the ditching. That lack of information gave the flight attendants the impression that it could happen at any moment, so when they were briefing the passengers on the donning of their life vest, they did not tell them to unfasten their seat belts and stand. The difficulty that some passengers experienced in putting their vests on would have been eliminated if they were standing up. The flight

3. attendants thought it would be safer to keep the passengers buckled in, in case they hit the water rather than have everyone die on impact.

4. There should be standardization of flight attendant training so that we would be able to assist in any emergency, regardless if we were the working crew, or just pass riding on another carrier.

   The F.A.R. annual minimum recurrent training is 12 hours. Our recurrent training is 8 hours. Eastern Airlines has an exemption from this requirement. Eight hours is not long enough to cover all the material, especially when we are qualified on 5 different pieces of equipment. Our training pay is $3.11 an hour, certainly no economic barrier to upgrading our training.

   Just in the last few years Eastern Airlines has begun building our trips by crew compliment, instead of equipment. This means that flight attendants who know and perfer to work the 727 may have one or two legs on a DC9-51 that they haven't seen for 6 months. There are more extreme examples. During the course of a two day trip, we could be working three different types of aircraft. This presents a problem because most of the emergency equipment and procedures vary from aircraft to aircraft, and we constantly are having to distinguish the differences during one on duty period. Please see the enclosed copy of the June 1983, Miami Bidsheet for illustrations.

5. It is impossible for us to frequently monitor the lavatories for smoke or fire inflight because we are performing our service duties. It is a common practice that passengers smoke "joints" in the lavatories, Therefore, there is a need for smoke detectors in the lavatories. Automatic fire extinquishers could react earlier than we could, and they do not become incapacitated from toxic fumes. They would increase the safety factor. Flight attendants presently have no protection against toxic fumes, (like the Scott Hood) and we could be overcome while we were fighting an inflight fire.

6. At Eastern Airlines most aircraft (except the DC9's) are overwater equipped with life preservers and rafts, and every flight attendant is overwater trained. This is not so at every carrier. We know that you don't have to be 50 miles from shore to land in Pensacola Bay or the Potomac. Every commerical aircarrier should have its flight attendants trained in ditching procedures and be equipped with vests and rafts.

7. On our 1011 aircraft we have only 4 mushrooms in the cabin. During the height of the meal service we could have 14 carts in the cabin, 11 without any way to secure them during turbulence. Eastern Airlines procedures say that we should bring them to the mid-service center and put them down below in the galley to be secured on mushrooms. The F.A.A. is satisfied with this procedure. How ludicrous. How are we supposed to be wheeling them down the aisle in turbulence?

7. Management says that no carrier has had a passenger or flight attendant injured by a flying cart. I find that hard to believe and have no proof to the contrary.

8. There is a need to standardize emergency equipment and its location on the aircraft, regardless of the carrier. There should be halon extinquishers on every plane, since it is the only effective method of fighting gasoline fires (our latest trend in hijacking weapons). We have them only on our A300's and 757's.

9. There is no F.A.A. approved infant bracing position because they have never bothered to do any testing. Therefore, the carriers are left to their own devices without any guidance. This year we have an alternate method, besides the old stand-by of holding the baby in your arms.

   The "under two year rule" for unticketed children is really unenforceable. We should be using a height requirement, as they do for rides in amusement parks, if we are really concerned about children's safety.

10. The F.A.A. doesn't set any maximum flight times or minimum rest breaks for flight attendants. We can be flying for 16 hours with only a 6 hour rest break and are expected to evacuate an aircraft. This is folly. Will there have to be fatalities in an accident because the flight attendants were too exhausted to perform their duty effectively, to get this issue addressed? Not every carrier's flight attendants have contractual minimum rest breaks or maximum flight or on duty hours. The public is entitled to receive the same degree of safety, regardless of the carrier.

11. The F.A.R.'s are not enforced. How many times have you seen a drunk passenger boarded on a flight? Are all the carry-on bags stowed? Is there a sterile cockpit between the gate and 10,000 feet? Are the passengers and crew standing on the taxiways? We need more inspectors out there on the line to enforce the regulations that we have on the books, since the carriers obviously don't stress their importance in our training. Management has admitted paying flight attendants' fines for standing up on the taxiways, because they said they didn't make it very clear in training.

12. If we are going to link fatalities to conditions in the cabin, it is vital that there be autopsies on all aviation accident victims. We need to document these correlations instead of saying seat failure, smoke or toxic gases.

13. Studies should be conducted to find out if the effects of alcohol consumption in combination with the toxic gases or smoke, lower our tolerance to these contaminants. Could that free liquor service on Air Canada contributed to any of the fatalities? If that is the case, the public should be informed of the risks,

13. so they can make an informed decision to drink or not to drink.

14. Carry-on-bags are a balooning problem. The old rule of thumb of one piece per passenger went out with the overhead racks. Now that we have enclosed bins, literally the sky's the limit! A handbag, a briefcase, a garment bag and a tote bag, all under tow by one passenger is not an uncommon sight. Now agents let anything on until we tell them otherwise. Overhead bin manufacturers are selling their products by telling the carriers they can reduce turn time and baggage handlers if the passengers carry their own on & off the aircraft. See enclosed ad and article.

These are just some of my thoughts, I could go on and on. When the Hearings reconvene,if you need any assistance, please do not hesitate to ask. Also please find a copy of all the various flight attendant union presidents and safety representatives names and addresses. I am sure that they too would gladly help in anyway possible. Patricia Fink and I will be available to testify before the committee if we are needed.

Respectfully,

Betsy Murtagh

Elizabeth H. Murtagh
National Safety Director

EHM:hcr
opeiu #128
AFL-CIO

cc: Executive Board, Local 553

Enclosures (3)

NFPA
"Moving Mankind Toward Safety From Fire"

NATIONAL
FIRE PROTECTION
ASSOCIATION
INTERNATIONAL

Capital Gallery, Suite 220
600 Maryland Avenue, S.W.
Washington, D.C. 20024
(202) 484-8200
Telex No. 904024

DOC #
REC #
AIDE
CATS
PARA
1983

August 26, 1983

The Honorable Elliott H. Levitas
Chairman
Investigations and Oversight Subcommittee
Public Works and Transportation Committee
U.S. House of Representatives
2416 Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. Chairman:

Enclosed is a copy of a statement submitted by the National Fire Protection Association (NFPA) for the record of the hearings held July 12, 13 and 14, 1983, regarding Aircraft Cabin Safety. The NFPA, as a principal public advocate for fire safety, would like to make its long-standing concern in the area of aircraft cabin safety known to the Committee.

The NFPA has long been involved in aviation safety and presently produces 18 aviation standards developed through its consensus processes. These standards are widely adopted by local, state and federal agencies and departments for construction, design and operational fire safety of aviation facilities and non-operational aircraft.

We would be most happy to answer any questions the Committee may have in regard to the hearing statement or to aircraft and airport fire protection and safety or in additional areas of concern. We would also like to offer our assistance in the Committee's future efforts in this area.

EXECUTIVE OFFICE: BATTERYMARCH PARK, QUINCY, MASSACHUSETTS, U.S.A. 02269 • TELEPHONE (617) 328-9290 • TELEX 94-0720

The non-profit technical and educational organization: To promote the science and improve the methods of fire protection and prevention, to obtain and circulate information on these subjects and to secure the co-operation of its members and the public in establishing proper safeguards against loss of life and property by fire.

Thank you for your continued concern and attention to the problem of aircraft cabin fire safety. The NFPA supports your belief that technology is available now which can enhance passenger fire safety aboard commercial passenger aircraft.

Sincerely,

John C. Gerard

John C. Gerard
Washington Representative

JCG/scy
Enclosure

Statement Submitted for the Record

by

John C. Gerard
Washington Representative
National Fire Protection Association

AIRCRAFT CABIN SAFETY

The recent in-flight fire aboard an Air Canada DC-9 with the resulting deaths of 23 passengers on June 2, 1983 has called to the public attention the longstanding issue of aircraft cabin fire safety. While the plane was able to make a controlled emergency landing at Cincinnati Airport, nearly half the occupants of the plane perished after a flash-over fire swept the cabin once the forward emergency door was opened.

This fire raises several issues involving aircraft cabin fire safety upon which NFPA would like to comment on behalf of the hearing record. In particular, the NFPA is concerned that conditions known to produce the rapid, intense fire in cabin interiors have long been identified. Fire safety technology to overcome or ameliorate these conditions has long been known and, in some cases, applied voluntarily within the airline industry to enhance aircraft protection and passenger safety. Those safeguards have not, however, been required by FAA regulations which manditorially apply throughout the commercial airline industry.

Specifically, NFPA would like to comment on cabin interior flammability and the application of early detection and suppression systems in relation to aircraft cabin safety.

THE NFPA

The National Fire Protection Association (NFPA), founded in 1896, is a non-profit, technical and educational membership organization. It has remained the principal public advocate for fire safety since its inception.

The Association's membership of over 32,000 is drawn from the many disciplines involved in, and concerned about, the national fire problem. NFPA is not a trade or industry association. No one group or interest is dominant. The only common membership denominator is a concern about fire safety. Members include fire service personnel, fire marshals, electrical inspectors and city managers; architects, engineers and educators; health care facility operators and similar groups from commerce, transportation, industry, insurance and the Federal Government. The NFPA is best known for its voluntary safety standards, collectively known as the National Fire Codes which, in whole or in part, are incorporated by reference into numerous federal and state laws and into municipal ordinances.

NFPA'S AVIATION SECTION

A portion of the NFPA membership is organized into an Aviation Section. Organized since June 17, 1980, this section contains members who are engaged in the design of aircraft or airport facilities, or in the operation of aircraft or airport facilities; or in the protection against or prevention of loss or injury as applied to aircraft or airport facilities. Included specifically are design engineers of aircraft, airport facilities or fire protection equipment, operators of airport facilities, pilots, airport fire service and fire marshal personnel and others who have an interest in the objectives of the section.

AVIATION STANDARDS

The NFPA developed their first Standard Operating Procedures for Aircraft Rescue and Fire Fighting in 1949 (NFPA No. 402) from experience gained in

World War II. These standards covered all aircraft from the Piper Cub to the largest aircraft, the Boeing 377. Since that time, these standards have been constantly upgraded in keeping with industry expansion and the state-of-the-art to protect the single engine Cessna to the Boeing 747. The NFPA issues standards and recommended practices covering all aspects of airport safety, aircraft fuel servicing, aircraft extinguishers, electrical, oxygen and fuel system maintenance, aircraft painting and welding, cabin cleaning, airport hanger and airport terminal fire protection to name a few.

One important document, the Aircraft Rescue Procedures and Fire Fighting and Services Manual is written by a committee of 50 experts drawn from the entire industry, including representatives of the armed forces, government agencies, aircraft manufacturers, agent and vehicle manufacturers, airline employees and airport management. Six different countries are represented on the committee.

The committee members determine what, in their expert opinion, is required to provide adequate protection for the traveling public. The NFPA standards-making process is strictly controlled, and all documents are distributed for public comment prior to being placed before the membership for ratification. Our standards are recognized throughout the world as the best available in the industry and are widely adopted for use by many local, state, and Federal agencies and departments.

The NFPA presently produces 18 standards related to aviation safety, including the areas of aircraft fuel servicing, aircraft maintenance operations, airport facilities and aircraft rescue and fire fighting. A full listing of the standards is listed in Table 1 on the following page.

TABLE 1

NFPA Standard No.	Title
402	Aircraft Rescue, Fire Fighting, Standard Operating Procedures
403	Aircraft Rescue and Fire Fighting Services at Airports and Heliports
406M	Aircraft Rescue, Fire Fighting Techniques for Departments Using Conventional Apparatus and Equipment
407	Aircraft Fuel Servicing
408	Aircraft Hand Fire Extinguishers
409	Aircraft Hangars
410	Aircraft Maintenance
412	Aircraft Foam, Fire Fighting Vehicles, Test Procedures
414	Aircraft Rescue, Fire Fighting Vehicles
415	Aircraft Fueling Ramp Drainage
416	Airport Terminal Buildings
417	Aircraft Loading Walkways
418	Roof-top Heliport Construction and Protection
419	Airport Water Supply Systems for Fire Protection
421	Aircraft Interior Fire Protection Systems
422M	Aircraft Fire Investigator's Manual
423	Aircraft Engine Test Facilities
424	Airport/Community Planning.

AIRCRAFT INTERIOR PROTECTION

NFPA No. 421, Recommended Practice on Aircraft Interior Fire Protection Systems (1973), covers the installation of fixed or portable automatic aircraft interior fire detection and suppression systems to control fires during aircraft construction, maintenance and overhaul. The standard is not intended to be applied while the aircraft is operational. However, the conditions and the basic principles of protection are directly applicable to operational aircraft cabin fire safety. The NFPA standard recognizes, in particular, the combustible characteristics of cabin interiors which contribute to intense aircraft interior fires.

AIRCRAFT INTERIOR FINISH

Aircraft cabin interiors are generally furnished with a wide range of combustible materials which, when ignited, can produce a severe fire unless suppressed or extinguished early. Typical finishing materials that may be found on board a modern transport-category aircraft include a variety of plastics such as polyvinylchloride, polyurethane, ABS (acrylonitrile butadiene styrene) polymers, polyester carpeting, as well as various structural plastics such as polycarbonates and polysulfones. Additional ordinary combustibles would include seat upholstering materials, pillows and blankets.

An aircraft fuselage, enclosing a cabin, may be seen as nearly a perfect cylinder permitting heat, smoke and combustible fire gases to accumulate under fire conditions. Once a fire has developed, heat may be reradiated from surface to surface resulting in the development of flammable and volatile gases which may collect and result in a flash fire, which can involve major portions of a cabin very rapidly. Rapid spread of fire, smoke and combustible gases may also be influenced by air currents (drafts) within the fuselage and by entry of the fire into the concealed spaces between cabin liners and the exterior aircraft skin.

Fire loss experience indicates that fire growth, time to flash-over and subsequent flame spread rates are greatly influenced by the materials initially involved.

- Fires of flammable liquid origin are likely to develop very rapidly and be of flash-fire type.
- Fires originating in oxygen systems, or resulting in the release of oxygen, spread rapidly due to oxygen enrichment.
- Fires of electrical origin are usually of the smoldering type at time of origin resulting from localized overheating or arcing of on-board electrical equipment or devices igniting adjacent combustible materials. Although they may be slow developing, such fires may occur when the aircraft is unattended or start in concealed spaces (as behind cabin wall or ceiling liners) and spread throughout the aircraft before effective action can be taken.

In addition, aircraft interior fires are often characterized by the generation of toxic products of combustion, combustible gases and dense, black smoke. Within a short time, the heat, toxic gases and smoke generated will make the atmosphere of the aircraft interior untenable unless personnel wear special clothing and self-contained breathing apparatus. Further, the opening of a door for entry or other purposes may cause a severe flash fire. These factors may also prevent effective manual fire fighting.

Because of the factors listed above, NFPA recommends that protection systems set forth in NFPA No. 421 should be installed to detect, suppress and extinguish such fires automatically without reliance on manual intervention or initiation when planes are being constructed, maintained, and overhauled. Conditions within operational aircraft are often times the same, yet the level of protection required by FAA regulation is substancially less.

EARLY DETECTION

Since 1974, the National Transportation Safety Board (NTSB) has recommended that all airliners should have smoke detectors and automatic fire extinguishers in their lavatories. To date, the Federal Aviation Administration (FAA) has rejected the recommendations for cabin smoke detection as being unnecessary recommending instead frequent inspection by the flight crew. Yet frequent inspection is not necessarily sufficient to give early warning of fires. Because of concealed construction, compartmentation and the ventilation of aircraft lavatories, smoke from incipient fires in lavatory areas may not be detected in cabin areas until a serious fire is in progress. Since aircraft interior fires can develop and spread rapidly, accompanied by intense heat and smoke, early detection and initial warning of fire can provide additional time in which to deal with the fire while it is still small or in its incipient stage giving the flight crew vital minutes in which to take significant action.

DETECTION, ALARM AND SYSTEM ACTUATION

The detection and alarm devices used with the fire protection system recommended for aircraft interiors should perform the following basic functions:

- Detect incipient fires providing a local, automatic, audio and visual alarm to alert the flight crew to the fire conditions and its location.
- Provide sufficiently early automatic detection to, in turn, provide opportunity for nearby personnel to use any appropriate portable fire extinguishers available. It is important to reduce the probability of a flash-fire occurring due to the uncontrolled development of combustible gases and to prevent hazardous accumulation of toxic gases and smoke within the aircraft.
- Detect the fire before heat development constitutes a thermal threat to the protected aircraft.
- Initiate discharge of the fire suppression system.

PREACTUATION ALARM EQUIPMENT

It is important to note that smoke detection is now required in many states and localities to protect buildings and their occupants, some of which may contain only one or two persons to those containing many thousands. Yet, smoke detectors, a proven life safety technology, have not been required to protect aircraft passengers. It is particularily significant to note that some air carriers and manufacturers, recognizing this capability, have already voluntarily installed them in lavatory and galley areas of aircraft of both new and existing commercial passenger aircraft. It is also interesting that present FAA regulations require commercial aircraft to have smoke detectors and automatic fire extinguishing systems in cargo compartments but not in passenger areas.

AUTOMATIC EXTINGUISHING SYSTEMS

Aircraft fires in 1974 prompted the NTSB to recommend that automatic fire extinguishing systems be installed in lavatory waste paper containers in all transport aircraft. In conjunction with automatic smoke detection, automatic fire suppression systems can be activated automatically in concealed or inaccessible spaces, or in open aircraft interior spaces such as lavatory compartments, to suppress or extinguish a fire while still in its small incipient state. The NTSB recommendation recognized that ". . . small, self-contained fire extinguishers can be installed in small compartments such as lavatory waste containers. These extinguishers are charged with a nontoxic agent and discharged automatically when the compartment temperature rises to a hazardous level. The cost of one extinguisher is below $50, and installation is simple." This technology, though readily available, has not been applied aboard passenger aircraft generally, although some airlines have voluntarily chosen to install such protection.

SUMMARY

The NFPA believes that fire protection technologies have been in existence for many years which, if applied, would greatly enhance aircraft cabin fire safety. Automatic systems to detect fire at its earliest stages have long been in use. Automatic fire extinguishing systems are also readily available. Materials which can reduce the flammability and toxicity of aircraft interior finish have been available for years.

In spite of the experiences of earlier aircraft tragedies, studies and recommendations by the NTSB in this area, there has been little action as study after study is conducted. The NFPA encourages deliberate haste on the part of the FAA in proceeding with the promulgation of rulemaking in this area and with the implementation of regulations which require that fire protection technologies which have long been available are finally applied for the benefit of aircraft passenger safety.

AVIATION SAFETY

(Aircraft Passenger Survivability and Cabin Safety)

TUESDAY, NOVEMBER 1, 1983

House of Representatives,
Subcommittee on Investigations and Oversight,
Committee on Public Works and Transportation,
Washington, DC.

The subcommittee met, pursuant to call, at 10:12 a.m., in room 2154, Rayburn House Office Building, Hon. Elliott H. Levitas (chairman of the subcommittee) presiding.

Mr. Levitas. The Subcommittee on Investigations and Oversight will please come to order.

On July 12 of this year the subcommittee began what we anticipate will be a lengthy and hopefully exhaustive review of the record of the Federal Aviation Administration in managing and regulating safety systems. It will be lengthy because we expect to cover in very extensive detail all the cabin safety issues which have been identified in the past and during aviation safety hearings by this subcommittee.

Exhaustive, because we fully intend to develop testimony both pro and con on each of these issues until there will remain no obstacles to the issuance of proposed ruling and ultimately the rules themselves.

The litany of needed safety measures which have been read into the record in earlier hearings, dating in the case of this subcommittee back to 1976, needs no repetition this morning. We all know them.

What we expect to result from these hearings is some positive action to move some of the recommendations from research and development to the center stage of reality through their adoption and promulgation in the rulemaking process.

I believe Congressman Molinari put this whole process in the correct perspective when he remarked at those July hearings that he didn't think we are going to be able to stick around here much longer and permit this to go on, meaning to allow safety conditions to remain at a stalemate.

It was his conclusion that the people out there, the air traveling public that we represent, expect a lot more from their Congressmen and that the FAA should be held accountable for the mission they have been assigned.

When the July hearings ended, I indicated that our oversight activity would be vigorous and persistent in an effort to get some major and significant and new improvements in cabin safety. So far there has been no significant change in that direction.

I believe it is a fair statement to say that in the past we have been somewhat critical of the on again/off again rulemaking proposals of FAA, especially in the areas of fire, smoke, and toxicity issues. Specifically, we have discussed in past hearings the failure of the agency to promulgate rules requiring the use of more fire-resistant and retardant materials on aircraft interiors.

We have specifically heard testimony on the availability of fire-blocking layers for aircraft seats included among the varied subjects discussed by witnesses from NASA and industry. Recently the FAA issued a notice of proposed rulemaking on seat-blocking layers, and while we are impressed with the speed with which this proposal was issued, and I note it was issued shortly after our July hearings, we wonder whether this could have been issued earlier and I mean by that much earlier.

We have invited the FAA Administrator, Lynn Helms, today, who I realize has inherited many of these problems from his predecessors, to explain to the subcommittee the difficulties encountered by the agency in reaching the point in time where this proposal could be adopted.

Management of the FAA safety programs has been criticized in the past, and we are pleased that Mr. Helms has seized upon this occasion to brief the subcommittee on the agency's aircraft safety program.

It is our belief that a well-managed program could certainly shake loose from the bowels of the agency many safety recommendations and suggested improvements which have been languishing in limbo for a lack of a decisionmaker to push them into the forefront. I might note that in past hearings the thing that strikes me the most is that we always raise the same questions, we always hear the same answers, "Something is going to be done about it, we are studying it" and it seems to get to the point where something is about to happen and then it stops.

This is a scenario that has not been going on for 1 year or 2 or 3 or 4 or 5, we are talking 8, 9, 10, 11 years. I have said before because I sincerely believe it, that lives have been unnecessarily lost because of the failure of industry and the Government to take prompt action. I hope that Mr. Helms will bring his leadership ability to the forefront and we need not a mouse, we need an elephant in response to the problem.

At this point I would like to inquire whether the ranking member who has just arrived, has a statement? I might say this: I am a member of the Government Operations Committee and generally sit where Mr. Stratton is now sitting, and the seat that I am occupying on this occasion is generally occupied by the chairman of my Government Operations Committee, Jack Brooks, the gentleman from Texas.

As everyone knows, Jack Brooks is considered to be one of the mildest, kindest, gentlest Members of the House of Representatives and I know that sitting in his seat today I will take on those same attributes and depart from my normal prickly method of dealing with matters, but be more like Jack Brooks on this occasion.

At this time, now that Mr. Molinari has had an opportunity to take his seat, I will recognize the gentleman from New York.

Mr. **Molinari**. Thank you, Mr. Chairman.

After listening during the 3 days of hearings that we had in July to the tales of inaction on the part of FAA's cabin safety program, I am very interested in hearing from that agency today. I fear that the problems are such that simplistic solutions would probably create even greater hazards. It has appeared, however, that the program in the FAA has proceeded at a pace much slower than one would have expected and it raises the question of whether there is any real interest in completing these projects.

The FAA Technical Center has been testing seat materials for many years in its excellent facility, but until recently, for all of the definitive direction which has emanated from this testing, it may never have done any at all.

Now, after some 7 years of testing and study, we have two NPRM's concerning the fire-blocking layer on aircraft seats and one proposed improved emergency exit lighting.

I understand there are several other proposals due out in the next year.

I hope the testimony today relates just what has happened to bring the FAA to the decision that enough study has been done to warrant some move toward putting the results into aircraft.

At the speed demonstrated by past performance, by the time the program has been identified, studied, and solutions tested, and NPRM published, comments received, and so on, it appears that 10 to 15 years could pass and the problem could no longer concern us.

I hope there will be some thought given to streamlining the process that seems to be based on procrastination. You can rest assured that we on the subcommittee will be paying close attention to the progress made toward solution to the many problems we have heard discussed over the past several years.

I might add that during one of the past hearings, Mr. Chairman, I was rather shocked when I learned of the substance that was developed by NASA, polymides, I think, was the enunciation of the material, and no one testifying at that time seemed to have an awareness of the material. It was something new that I had learned about and when we questioned the panels, none of them had any awareness of what it was and then I learned the same day that there had been a press release issued by NASA some 2½ years ago describing the material.

I understand in my subsequent inquiry that there have been some questions raised about the durability of the substance. That might have been the reason why it was not adopted at the time. I also understand that there have been changes made in that material and certainly something that offered such great promise almost 4 years ago now, should have been, in my judgment, more thoroughly investigated and perhaps would be a better answer than the blocking layer we are talking about today.

But I know, Mr. Chairman, Mr. Helms plus the other members of the panel are here today to try to help us in solving some of these problems and I truly believe that they want, just like we do, to see that we improve the quality of aircraft safety.

Thank you, Mr. Chairman.

Mr. LEVITAS. Thank you, Mr. Molinari.

The gentleman from Texas, or the gentleman from Georgia.

If there are no further opening statements, then at this time we would proceed with hearing from the witnesses from the FAA [Federal Aviation Administration] this morning.

Mr. Helms, if you and your colleagues would please raise your right hands, anybody who will be testifying today.

[Witnesses sworn.]

TESTIMONY OF HON. J. LYNN HELMS, ADMINISTRATOR, FEDERAL AVIATION ADMINISTRATION, ACCOMPANIED BY ANTHONY J. BRODERICK, DEPUTY ASSOCIATE ADMINISTRATOR FOR AVIATION STANDARDS, NEAL A. BLAKE, DEPUTY ASSOCIATE ADMINISTRATOR FOR DEVELOPMENT AND LOGISTICS, AND THOMAS O'BRIEN

Mr. LEVITAS. We look forward to your testimony.

Mr. Helms, I will recognize you and if you would be good enough to introduce your colleagues for the record.

Mr. HELMS. Very good, sir, thank you very much, and Mr. Molinari.

With me today on my left is Mr. Neal Blake, the Deputy Associate Administrator for Development and Logistics; on my right is Mr. Anthony Broderick, the Deputy Associate Administrator for Aviation Standards.

Depending on the nature of the questions which may come up, I may call on Mr. Thomas O'Brien, who is behind me on the left, and did also swear to the truth of statements we are about to make.

The reason I have Mr. O'Brien is because he has been at the Tech Center and I could envision the possibility of some questions that may arise you may wish to get into in depth.

Gentlemen, you have asked me to appear before the subcommittee today to discuss the FAA's cabin safety program. I am pleased to have this opportunity because I believe it is important that the FAA's side of the story continue to be told. I am obviously aware of some of the views expressed in recent hearings on this subject before this subcommittee—views which suggest that the FAA has intentionally failed to act on important safety materials, that the FAA ignores new technology which could save lives, that the FAA cares only about the economic consequences of its regulatory actions and not safety. And these matters have been commented on by the chairman and the ranking minority member.

These implications are simply incorrect; in fact, we have recently taken several important safety steps. I will not hesitate to accept responsibility for the actions taken in our cabin safety program during my stewardship of the agency, and I encourage a constructive dialog on this issue because it can only make our program better to have such an exchange of information and views.

Certainly all of us concerned with improving aviation safety welcome public hearings such as this which enable the Congress to fulfill its oversight functions and help ensure that the public is informed. I think it is important to demonstrate to the public that our legislative and regulatory decisions are not made in isolation from those who are affected by them. In fact, the public comment period for notices of proposed rulemaking is designed to achieve meaningful input on a national level from all points of view, not just those of any particular group representing a special interest. Our regulations must be evenhanded and fair—they cannot unduly burden one segment of society in order to benefit another.

In order to prescribe reasonable regulations, many factors must be assessed, of which one key element is the evaluation of costs versus benefits. It is fundamental to American society that there is an economic factor to be considered in most decisions, and, in fact, we all do this in our daily lives. We mentally trade off costs and benefits in making decisions such as whether to buy a new car or keep the old one for another year, whether to buy a house or rent an apartment, whether to drive to work or use the Metro. Cost-benefit analyses must be made in aviation as well. Therefore, it seems only fair and appropriate that, while a particular group may argue that costs are not relevant, those who are to be regulated should be given the opportunity to be heard on the issue.

If they do not agree with our studies, they should be afforded the opportunity to give us theirs. Then we can turn to the traveling public, the airport operators, the private flyers, the municipalities that represent the local citizenry—and any others who may wish to be heard—to tell us whether they believe the benefits justify the costs. Ultimately, of course, the FAA Administrator must make the final decision concerning safety.

Let me briefly pursue this one step further. With respect to fire-resistant cabin materials, witnesses have appeared before this subcommittee and indicated that "we had fire-resistant materials years ago." By now, this subcommittee is no doubt aware that some materials generate toxic gases, and some of the materials that passed the flame test may lose part of their fire resistant properties as a function of wear—the constant sliding of passengers on the seats apparently breaks down some of the cellular or even molecular properties.

There are more problems, but I will use these two alone and show you how the failure to adequately examine this issue could have led the FAA to adopt premature regulations which no reasonable person could accept.

Let me describe what would have happened if we had issued a regulation and required its immediate implementation upon development of the first materials, the polymides, which produce tolerable levels of toxic gases, and which could successfully function as an improved fire performance cushion. That of course refers to the fire resistance capabilities.

Each of the airplanes would have had to be taken out of service every 60 to 90 days to replace the materials that decayed due to wear, according to wear tests conducted by industry. Due to the lost revenue from that airplane, the prices of all other tickets would have gone up dramatically to offset that lack of revenue and the increased cost. And of course, tens of thousands of people would have lost their jobs, since, even with a rotating plan, the air carriers would have fewer airplanes in the air—which also means fewer options for the traveling public and a further increase in the travelers' costs.

On a 90-day schedule, seats would have to be replaced four times a year, and the cost could then be rounded off to $160,000 per aircraft per year. Multiplying that by approximately 2,500 air carrier aircraft results in $400, million per year in aircraft costs alone. It takes little mental effort to see that jobs lost and other items, such as ticket price increases, could easily exceed half a billion dollars every year.

Thus, I hope you can see that a simple statement that "those materials were available years ago" misleads the Congress and misinforms the American public. It is likewise misleading to state that "FAA is concerned only with the economic impact of regulations, not safety." Certainly, the problems I have outlined to you could be described as economic. But at some point it is critical to realize that our regulations must stand up in the real world. A "wonder" material which wears out every 60 to 90 days is simply not a practical solution to the problem. It would have been irresponsible rulemaking to issue a regulation requiring the use of the material without having done durability studies, or without heeding industry comments that the material wore out in 2 to 3 months.

It is unlikely that such a regulation would pass legal scrutiny. Believe me, Mr. Chairman, no one in this room is more anxious than I to see improved fire-retardant materials placed aboard aircraft. Without exception, I know this committee, the staff, are interested in this above all other items. But I am not going to issue a rule without knowing the consequences of that rule. I am simply not going to use the air traveling public as guinea pigs to test our materials which are flame-resistant, but may give off excessive emissions, or which may become ineffective after 2 or 3 months.

At the same time, I could not issue a rule which says materials must meet new standards for fire resistance until we had developed a test that measures these parameters and correlates to the real-world conditions encountered in an aircraft fire. This is the most important item. The most important single item was to develop the test, to develop the test method and the standard. You will see later on in our summary that that becomes critical to any action that should be taken.

We have recently developed such a test, thus giving us, for the first time, the basis for the NPRM we have just issued concerning seat-blocking layers. The materials now available through additional work by NASA and American industry are lightweight, yet durable, and significantly improve the fire-resistance of seat cushions while generating less emissions.

When the test method and satisfactory blocking materials became available from our engineering efforts, I did not hesitate to move forward with appropriate regulatory action. Developing a test method was the key, which has allowed industry to come forth with new, more cost-effective materials with the required improvement in fire safety.

Since we announced our regulatory intentions, industry has provided over 190 materials, actually yesterday I checked and it was 192 materials—for testing to the proposed new standard, and 90 have passed the proposed criteria. Boeing is now conducting wear tests on the promising fabrics.

This example illustrates the point that a research project is not successful unless it solves or ameliorates the problem, and does not create a worse alternate problem. In the case of the early advanced seat cushion materials, there was a worse alternate problem—increased wearout, perhaps even complete failure in 2 to 3 months.

Since the last time the FAA appeared before the subcommittee on this topic, we have taken several actions to improve occupant safety in survivable accidents. Such actions include a new technical standard order [TSO] for life preservers incorporating improved donning and buoyancy requirements, a new TSO for child restraint devices, and adoption of the new TSO for crew member protective breathing equipment.

We have recently proposed regulatory action in a number of specific areas relating to cabin safety. For instance, as was noted by the chairman and the ranking minority member, we recently issued an NPRM on floor proximity emergency lighting. This was based on evacuation tests run at the Civil Aeromedical Institute [CAMI] which demonstrated a significant decrease in evacuation time from an aircraft cabin containing large amounts of smoke—which tends to gather in the upper portion of the cabin and obscure traditional exit markings.

We have nearly completed a high-priority NPRM requiring at least two Halon fire extinguishers on board each air carrier aircraft, and also requiring installation of smoke detection systems and other fire protection measures in lavatories and galleys. Other areas in which we expect to enter rulemaking soon include requirements for crew member protective breathing equipment and improved cargo compartment fire protection. I will elaborate more on these later in my briefing on the total technical program.

We expect to take a number of regulatory actions in the future which result from our efforts over the last few years. In spring of 1984, we intend to propose a requirement for shoulder harnesses on all seats in general aviation aircraft, and issue a notice in the Federal Register discussing analytical techniques developed by the FAA that can be used to improve aircraft crashworthiness.

By spring of 1985, we plan to issue NPRM's containing new requirements for seat strength for FAR parts 23, 25, 27 and 29. For fire safety, we intend to propose new standards for class D cargo compartment fire containment by the end of this year, and standards for antimisting kerosene, [AMK] and interior materials in air carrier airplanes by the end of next year. The agency is committed to these schedules, which are the logical conclusions of our past and present efforts in these areas.

I would now like to give the subcommittee an updated briefing on our current R&D projects in the area of aircraft safety, particularly cabin safety, and the regulatory products we expect to result from that research. Before I do, however, I want to clarify one thing for the record. I understand that some other witnesses before the subcommittee have characterized U.S. air carriers as resisting any safety improvements which cost money to implement. Mr. Chairman, this is completely contrary to my experience as Administrator. Since I have been with the FAA, whenever I have called or written the chief executive officer of a carrier to point out a safety item that should be addressed, without exception, they have quickly initiated corrective action.

I believe the carriers fully understand their duty to the traveling public concerning safety. For example, one air carrier began its program to explore conversion of its entire fleet to seat blocking materials even before we issued the NPRM. This does not mean that they will necessarily endorse every aspect of every safety proposal we make. And if they have concerns, we will listen to them and address them—as we do for all interested parties. I will not hesitate to push the carriers to make their operations even safer, and I will issue regulations when I believe they are needed in the interests of safety. But I could not let the record stand with the unfounded implications that U.S. air carriers contest safety improvements simply because they cost money.

At this time, I would like to brief the subcommittee on the FAA's aircraft safety program. This is a very comprehensive program dealing with a number of subprograms which are each very complex in themselves. Thus, I may not be able to fully convey to you the scope and significance of our efforts in these areas in the time alloted to me. I would like to take this opportunity, therefore, to reiterate the invitation we have made to you on a number of occasions, for the entire subcommittee to come up to the technical center in Atlantic City to examine our efforts firsthand and talk face to face with the engineers who are conducting the research we will discuss today.

I know that the chairman and the ranking minority member have visited our Civil Aeromedical Institute [CAMI] in Oklahoma, and I understand that you found this to be a worthwhile and enlightening experience. I am confident that you would find such a trip to the technical center to be equally valuable. We would welcome the opportunity to show the subcommittee and/or your staff our facilities in order to give you a better idea of what our programs involve.

With your permission, Mr. Chairman, I will now move to some charts so I can outline the program in greater totality.

[The prepared statement of Mr. Helms follows:]

STATEMENT OF THE HONORABLE J. LYNN HELMS, FEDERAL AVIATION ADMINISTRATOR

Mr. Chairman and members of the subcommittee, you have asked me to appear before the Subcommittee today to discuss the FAS's cabin safety program. I am pleased to have this opportunity because I believe it is important that the FAA's side of the story continue to be told. I am obviously aware of some of the views expressed in recent hearings on this subject before this Subcommittee—views which suggest that the FAA has intentionally failed to act on important safety materials, that certain matters the FAA ignores new technology which could save lives, that the FAA cares only about the economic consequences of its regulatory actions and not safety. These implications are simply incorrect; in fact, we have recently taken several important safety steps. I will not hesitate to accept responsibility for the actions taken in our cabin safety program during my stewardship of the agency, and I encourage a constructive dialogue on this issue because it can only make our program better to have such an exchange of information and views.

Certainly all of us concerned with improving aviation safety welcome public hearings such as this which enable the Congress to fulfill its oversight functions and help ensure that the public is informed. I think it is important to demonstrate to the public that our legislative and regulatory decisions are not made in isolation from those who are affected by them. In fact, the public comment period for notices of proposed rulemaking is designed to achieve meaningful input on a national level from all points of view, not just those of any particular group representing a special interest. Our regulations must be even-handed and fair—they cannot unduly burden one segment of society in order to benefit another.

In order to prescribe reasonable regulations, many factors must be assessed, of which one key element is the evaluation of costs versus benefits. It is fundamental to American society that there is an economic factor to considered in most decisions, and, in fact, we all do this in our daily lives. We mentally trade off costs and benefits in making decisions such as whether to buy a new car or keep the old one for another year whether to buy a house or rent an apartment, whether to drive to work or use the Metro. Cost-benefit analyses must be made in aviation as well. Therefore, it seems only fair and appropriate that, while a particular group may argue that costs are not relevant, those who are to be regulated should be given the opportunity to be heard on the issue. If they do not agree with our studies, they should be afforded the opportunity to give us theirs. Then we can turn to the traveling public, the airport operators, the private flyers, the municipalities that represent the local citizenry—and any others who may wish so to be heard—to tell us whether they believe the benefits justify the costs. Ultimately, of coaurse, the FAA Administrator must make the final decision concerning safety.

Let me briefly pursue this one step further. With respect to fire-resistant cabin mateials, witnesses have appeared before this Subcommittee and indicated that "we had fire-resistant materials years ago." By now, this Subcommittee is no doubt aware that some materials generate toxic gases, and some of the materials that passed the flame test may lose part of their fire resistant properties as a function of wear—the constant sliding of passengers on the seats apparently breaks down some of the cellular or even molecular properties. There are more problems, but I will use these two alone and show you how the failure to adequately examine this issue could have led the FAA to adopt premature regulations which no reasonable person could accept.

Let me describe what would have happened if we had issued a regulation and required its immediate implementation upon development of the first materials, the polyimides, which produce tolerable levels of toxic gases, and which could successfully function as an improved fire performance cushion.

Each of the airplanes would have had to be taken out of service every 60 to 90 days to replace the materials that decayed due to wear, according to wear tests conducted by industry. Due to the lost revenue from that airplane, the prices of all other tickets would have gone up dramatically to offset that lack of revenue and the increased cost. And of course, tens of thousands of people would have lost their jobs, since, even with a rotating plan, the air carriers would have fewer airplanes in the air—which also means fewer options for the traveling pubic and a further increase in the travelers' costs. On a 90-day schedule, seats would have to be replaced four times a year, and the cost could then be rounded off to $160,000 per aircraft per year. Multiplying that by 2,500 approximately air carrier aircraft results in $400,000,000 per year in aircraft costs alone. It takes little mental effort to see that jobs lost and other items, such as ticket price increases, could easily exceed half a million dollars every year.

Thus, I hope you can see that a simple statement that "those materials were available years ago" misleads the Congress and misinforms the American public. It is likewise misleading to state that "FAA is concerned only with the economic impact of regulations, not safety." Certainly, the problems I have outlined to you could be described as economic. But at some point it is critical to realize that our regulations must stand up in the real world. A "wonder" material which wears our every 60 to 90 days in simply not a practical solution to the problem. It would have been irresponsible rulemaking to issue a regulation requiring the use of the material without having done durability studies, or without heeding industry comments that the material wore out in 2 to 3 months. It is unlikely that such a regulation would pass legal scrutiny. Believes me, Mr. Chairman, no one in this room is more anxious than I to see improved fire retardant materials placed aboard aircraft. But I am not going to issue a rule without knowing the consequences of that rule. I am simply not going to use the air traveling public as guinea pigs to test out materials which are flame resistant, but may give off excessive emissions, or which may become ineffective after 2 or 3 months.

At the same time, I could not issue a rule which says materials must meet new standards for fire resistance until we had developed a test that measures these parameters and correlates to the real world conditions encountered in an aircraft fire. We have recently developed such a test, thus giving us, for the first time, the basis for the NPRM we have just issued concerning seat-blocking layers. The materials now available through additional work by NASA and American industry are lightweight yet durable, and significantly improve the fire resistance of seat cushions while generating less emissions.

When the test method and satisfactory blocking materials became available from our engineering efforts, I did not hestitate to move forward with appropriate regulatory action. Developing a test method was the key, which has allowed industry to come forth with new, more cost-effective materials with the required improvement in fire safety. Since we announced our regulatory intentions, industry has provided over 190 materials for testing to the proposed new standard, and 90 have passed the proposed criteria. Boeing is now conducting wear tests on the promising fabrics.

This example illustrates the point that a research project is not successful unless it solves or ameliorates the problem, and does not create a worse alternate problem. In the case of the early advanced seat cushion materials, there was a worse alternate problem—increased wearout, perhaps even complete failure in 2 to 3 months.

Since the last time the FAA appeared before the Subcommittee on this topic, we have taken several actions to improve occupant safety in survivable accidents. Such actions include a new Technical Standard Order (TSO) for life preservers incorporating improved donning and bouyancy requirements, a new TSO for child restraint devices, and adoption of a new TSO for crewmember protective breating equipment. We have recently proposed regulatory action in a number of specific areas relating to cabin safety. For instance *we recently issued* an NPRM on Floor Proximity Emergency Lighting. This was based on evacuation tests run at the Civil Aeromedical Institute (CAMI) which demonstrated a significant decrease in evacuation time from an aircraft cabin containing large amounts of smoke—which tends to gather in the upper portion of the cabin and obscure traditional exit markings. We have nearly completed a high priority NPRM requiring at least 2 Halon fire extinguishers on board each air carrier aircraft, and also requiring installation of smoke detection systems and other fire protection measures in lavatories and galleys. Other areas in which we expect to enter rulemaking soon include requirements for crewmember protective breathing equipment and improved cargo compartment fire protection. I will elaborate more on these later in my briefing of the total technical program.

We expect to take a number of regulatory actions in the future which result from our efforts over the last few years. In Spring of 1984, we intend to propose a requirement for shoulder harnesses on all seats in general aviation aircraft, and issue a notice in the Federal Register suggesting human tolerance limits to be used as performance criteria in improved seat design standards, describing in detail the elements of our crashworthiness program, and soliciting comments on both. In the summer of 1984, we intend to propose improved crash resistant fuel system components for general aviation airplanes. By Fall of 1984, we expect to publish a notice in the Federal Register discussing analytical techniques developed by the FAA that can be used to improve aircraft crashworthiness. By Spring of 1985, we plan to issue NPRM's containing new requirements for seat strength for F.A.R. Parts 23, 25, 27, and 29. For fire safety, we intend to propose new standards for Class "D" cargo compartment fire containment by the end of this year, and standards for anti-misting kerosene (AMK) and interior materials in air carrier airplanes by the end of next year. The agency is committed to these schedules, which are the logical conclusions of our past and present efforts in these areas.

I would now like to give the Subcommittee an updated briefing on our current R&D projects in the area of aircraft safety and the regulatory products we expect to result from that research. Before I do, however, I want to clarify one thing for the record. I understand that some other witnesses before the Subcommittee have characterized U.S. air carriers as resisting any safety improvements which cost money to implement. Mr. Chairman, this is completely contrary to my experience as Administrator. Since I have been with the FAA, whenever I have called or written the Chief Executive Officer of a carrier to point out a safety item that should be addressed, without exception, they have quickly initiated corrective action.

I believe the carriers fully understand their duty to the traveling public concerning safety. For example, one air carrier began its program to explore conversion of its entire fleet to seat blocking materials even before we issued the NPRM. This does not mean that they will necessarily endorse every aspect of every safety proposal we make. And if they have concerns, we will listen to them and address them as we do for all interested parties. I will not hesitate to push the carriers to make their operations even safer, and I will issue regulations when I believe they are needed in the interests of safety. But I could not let the record stand with the unfounded implications that U.S. air carriers contest safety improvements simply because they cost money.

At this time, I would like to brief the Subcommittee on the FAA's Aircraft Safety Program. This is a very comprehensive program dealing with a number of subprograms which are each very complex in themselves. Thus, I may not be able to fully convey to you the scope and significance of our efforts in these areas in the time allotted to me. I would like to take this opportunity, therefore, to re-iterate the invitation we have made to you on a number of occasions, to come up to the Technical Center in Atlantic City to examine our efforts first-hand and talk face-to-face with the engineers who are conducting the research we will discuss today. I know that the Chairman and the Ranking Minority Member have visited our Civil Aeromedical Institute (CAMI) in Oklahoma, and I understand that you found this to be a worthwhile and enlightening experience. I am confident that you would find such a trip to the Technical Center to be equally valuable. We would welcome the opportunity to show the Subcommittee and/or your staff our facilities in order to give you a better idea of what our programs involve.

Mr. LEVITAS. Mr. Helms, I might add that one of the places that I expect for the subcommittee to go on a field hearing during this Congress is to New Jersey, Atlantic City, NJ, facility, as well as some others. As you know, we have been to CAMI and we do want to see what is available because it ties in to a very great extent with what you are testifying to today.

Mr. HELMS. We will certainly welcome your visit, Mr. Chairman. Our overall program is laid out in six areas as is shown here: Crashworthiness, which I will elaborate on later in detail; antimisting kerosene; cabin interiors, and you will see how this flows through materials and what happens in there; a controlled impact demonstration; and evacuation, which is one of the two keys in survivability.

Two items transcend all others in the survivability of passengers: rapid evacuation and prevention or delay of flashover. Flashover was a phenomenon we did not fully appreciate until later in the program. I will elaborate on this also.

And finally, the supporting systems which support each of the six areas. Starting out I will take each area and follow it through so the subcommittee can see the evolution of the program that was in being, starting with the elements in place in the 1980's. Starting in the late spring of 1981 aircraft safety activities became a formalized program directed toward the integration of all of the elements addressing this subject. And finally, in my succeeding remarks I will show how we have taken this further.

In the case of crashworthiness, we initially started with general aviation impact tests. These were done for us by NASA at Langley using the old Apollo capsule test and demonstration rig. At the same time we had a program called KRASH, which was to take this data and develop an aircraft crash response. This model, which was based on the results of the crash tests made it possible for us to see how the impact forces were transferred into loads on landing gear, wing tips, propellers, and other sub-elements of the basic structure of the airframe. This point will come out again later in my description of another program where we again show that we must first establish an analytical model in order to be able to predict system performance under sets of conditions. This was underway in 1980.

From this we went forward to industry and had Boeing, Lockheed, and McDonnell-Douglas do a histogram of all the crashes involving their aircraft to see what the typical crash scenarios were for air carrier aircraft. Basically this comes down to takeoff, landing and unplanned or emergency landing crash scenarios. They then developed a series of detailed scenarios which identified and classified the elements that go into a "normal" airliner crash, if you will.

Based on the results of this effort, we initiated additional seat test work. I must pause and pick up the second part. Since we had developed the structure sub-element loads from this KRASH program we went into development of, and I regret I must back into some terminology we use, a seat-occupant model for light aircraft [SOMLA], a mathematical model which applied to one seat with one person in it rather than two or three connected seats.

Later on this will change as you will see. We took the loads data, once we formalized the program, and developed the SOMLA model which allowed us to mathematically start to analyze various designs of seats. From this seat test program we started to develop various activities. One of our primary interests was to see if static load testing, where you rigidly hold the seat and pull it or in some way strain it to see if it will break, causes testing the same thing to happen to the seat as dynamic load testing. In dynamic testing the seat mounted on the sled slams forward, hits something and then is broken.

This resulted in a confirmation that the results of static tests do parallel dynamic tests. It says that we can go either way. Although we always get better data with both types of tests, our testing confirmed that our static testing method had been sufficiently adequate.

As a part of this activity we have gone forward with dynamic load testing, and as you will see later in this program there is in fact some additional dynamic load testing. During this time period certain companies in industry picked this up and started doing dynamic seat testing to confirm our findings. Piper Aircraft Corp. took various seats to the automotive test facility in Marysville, OH. They would tilt the seats back, turn them at angles of 10 and 15 degrees and run tests to see what the effect of the impact was at varying tilt angles, since we cannot predict the angle that the aircraft would crash.

Numerous companies started doing work in this, time period, and some go back to earlier dates, to confirm the dynamic loads data. From this, then we started to develop improved seats. Now we are into late 1983 and we are at the point where we are developing various seat configurations which will undergo final testing at CAMI. These are seats that will have a design concept which will slowly bend and absorb the energy or the impact forces of a sudden stop, instead of rigidly staying fixed and hence, transferring the impact forces, medically speaking, to the occupant's bowels, lower colon and other areas.

A major item was to address the secondary problem of the seat staying affixed to the rails. We found from these tests that if the seat floor starts to crumble the ability of the seat to stay in place and maintain its integrity is drastically reduced. So we had to come up with an improved rail and seat attachment fittings in order to absorb buckling in the floor.

Other activities started during this same time period. Starting in late 1983, we will have a real-size cross-section of a DC-10 with various seats and instrumented anthropomorphic dummies installed. A series of tests will allow the DC-10 test section to be dropped from various heights to duplicate the impacts of various loadings in accordance with a human tolerance capability.

I said this was a single-occupant model for a light aircraft. From this we started to develop the human tolerance levels. There have been people testifying before this subcommittee who say that a human can stand 22 to 28 g's. Mr. Chairman, they are correct. If we go down and take a look at the data at the Aerospace Medical Institute which the Air Force runs in San Antonio—I have been there personally, I have looked at the data, I spent a half day on that subject alone—there is no question that they have data to show it. But their test specimens are between 18 and 43 years old. They are vigorous young males who have had a very high athletic capability. They are the epitome, if you will, of the homo sapien species. We must be able to accommodate the little old lady who is 80 to 83, or the person who may weigh 350 pounds. So we find that the human tolerance limit for civil aircraft cannot be measured by that program alone.

To expand this out, we joined with the Army on a program at Wayne State University in cooperation with the automotive industry—and the Army does this as part of their helicopter testing program—to determine what can be done at various levels of impact. We have other people working on this to establish what should be the 95-percent tolerance or the normal human tolerance limit.

These data then, together with the drop test results and improved seat performance, will go into the single-occupant transport aircraft seat models. Now, we will extend this to cover two seats side-by-side or three seats such as in the wide-bodies. Those tests will be conducted and by that point the mathematical model derived here will be confirmed on the SOMLA model. We will have data on improved seats, data from the drop test and results from this model; this will lead to the large transport impact.

This is what we have been working for some time, preparing a Boeing model 720 airplane, a four-engine airplane. We have transferred it to Dryden, NASA has it and is in the process of instrumenting it. I will get to that later to show how that fits into the overall program.

Finally, out of that will come more crash resistant fuel systems. A fuel system designed so that when the airplane crashes, if the wing breaks off, automatically there will be a valve that will shut off the flow of fuel. This will also feed into general aviation aircraft.

The first part of the crashworthiness activity is directed towards the crash scenarios, the seats, the dynamic loads leading to final values, and I will connect this in a moment if the committee will have a little patience.

With anti-misting kerosene, we have started out with a lab evaluation look at many items to try to see what could be done. I will not waste your time on that. I will say that out of this a combination of FM-9 with jet fuel which is what we now use—and I will show you an example of it later if you like—offered the possibility of being able to prevent fires. This is a long chain——

Mr. LEVITAS. Let me interrupt you there, Mr. Helms. When you start with your lab evaluation, could you tell us what use you made of the experience that the military has achieved?

Mr. HELMS. In which evaluation, Mr. Chairman?

Mr. LEVITAS. In the lab evaluation, at the entry level on AMK.

Mr. HELMS. In this area we have been in constant contact with Wright Field and others. We in the United States have examined many materials. For example, the Army came up with a possibility of using a gel-type material. The problem with it is that when you put the compound in it the fuel became jelled by the fuel cell and couldn't be pumped. Also, it could not stand low temperatures. So that each of these compounds that we tried had something that prevented it from working. They work well within 10 minutes, but if they had to sit for an hour the composition of fuels started to jell and couldn't be pumped.

If we left it overnight, for example, in Minneapolis where an aircraft might sit overnight, the next morning it was rigid. You couldn't get it in. So we used all the compounds and all the knowledge which NASA had, which the military had and we could not find a solution from this.

A company in the United Kingdom developed the long-chain polymer approach. From this we started a series of tests to determine whether in fact it was feasible and we established the feasibility of AMK as a compound. I must emphasize that because I will connect it up in a moment, in early 1981.

That is, we said that this compound, when put into jet fuel, could, in fact, with its long chain polymers hold the molecules of fuel together; hence, oxygen cannot get in-between the full particles so basically there is no fire. At least it is very unlikely.

If we had movies I could show you precisely. This expands that capability.

Fortunately for us, at that time we had what we refer to as the wing spillage facility come onstream. This is the facility where we have jet engines that fire up and blow air out over a model of a wing. We have actual wings out of which we will then spurt fuel as if the airplane had crashed. We ignite this to see what the flame propogation characteristics are.

We went through many, many, many of these various compounds. Once we got to AMK we saw, it is very effective in preventing fire. In fact, and I am oversimplifying to save time, in this case FM-9 showed that as a compound the airplane could crash and there would not be the big ball of fire which was the thing we were after.

Now remember earlier I said that two things were required for survivability: rapid evacuation, that more than anything else; two, prevention or delay of flashover in which the fire occurs inside. We will get to how we determined that.

This wing spillage facility allowed us to run all these compounds under many, many different tests. So we had established that that compound could do it. Now the question was, could the compound be used?

We contracted with Douglas Aircraft Corp. then in 1981 to use their DC-10 rig in which we would take this fuel under varying conditions and see what the pumps did. In some cases they did not work. Would the fuel metering devices that measure how much fuel is in the tank, would they work; would the seals in there be attacked by this compound?

It is one thing to say that you have a compound, it is another to say have I solved the problem or am I creating a worse problem? So these tests were run for a long time to see what change had to be made in seals, pumps, the amount of energy that would have to go into a pump which might increase the electrical voltage which would pop circuit breakers or cause fires. This rig testing then will continue.

At the same time we arranged with Rolls Royce and Pratt & Whitney Aircraft to run tests of this compound and variations of it on the engine. You can start to see the magnitude of the problem then when you say that if I put something in here that will degrade this from burning, how do I get it into a jet engine and not burn it which is the requirement. That is what I am after.

So now, I had found a compound which would work but it clearly indicated it was not a viable compound as yet.

From this then we then started to determine what had to be done in nozzle design so when the fuel comes out it can spray; the inside of a burner, for example the inside of a chamber may have a 3 to 4 thousandths layer of quartz feldspar, what effect would that have? Basically how would we get the fuel so that it would burn. These tests continued and now we are to the point where in a Boeing rig we are running engines. We now have fuel in, we have a fuel tank, we are running this as a normal routine.

We have taken advantage of what we learned in seals and other areas to put this in and see, is it functional? Can it now start to solve the daily operational problems?

Can you fuel the airplane, leave this fuel in overnight which most aircraft do, get up the next morning and go out and have it retain its fire prevention properties but still be such that we can in fact be sure it is going to work later on?

During this time period, then as a result of these tests which I said proved that the fuel element would work, that is, we could degrade it, take care of it, we came up with what we referred to as improved FM-9. That was early 1982. From this time on we found that the improved FM-9 solved most of these problems, but it required a completely separate large facility, tank trucks, to make that blend.

So what we have to do is take a look at the infrastructure across the United States. Do we say now that we must install an extremely expensive operation at every airport in the U.S. where a carrier may land merely to have this blended fuel? Cost-benefit—what would be the cost of that?

So we looked at it and said if we can take this and come up with a way in which we can blend this in line so that as you pour the fuel in through the blender then you insert FM-9, you now have a way in which you do not have to make a permanent installation at all airports in the United States. This can be a small portable unit which is attached directly to the fuel truck. As you fuel the aircraft, this goes in also. This is completed and we are in the final process of building three production prototypes which show this can be done.

Now that we have the fuel so that it won't burn when we get it into the airplane we have to find a way to degrade it so that it will burn. A degrader had to be built that could be attached to the engine, downstream or right along with fuel pumps so that at that point by some change the long chain polymers would not turn loose of each other, so that now the fuel would burn.

This degrader has gone through three models also; we now have a model which is working and we will have one on an 880 aircraft which we will start flying fairly shortly and that will have one engine and one fuel tank just for AMK-9 and the other engines will be normal. We have a situation where we can take samples. I am hesitant to say it (the undergraded fuel) won't burn there, and in fact we can put a degrader in as a piece of equipment like a fuel pump, or a carburetor or something that can stay on line, and from this write the final fuel specification.

This also leads to what we call the large transport impact which I mentioned up here a moment ago. I will start to connect those up at a later time.

Our third element was in cabin interiors, the one which the committee has primarily addressed itself to. Lab tests have been underway for some time. As the chairman noted, we have known about the materials for many years. Our problem was we did not have a test method nor a standard. Why is that significant? I can take any material and I can burn it in different ways and I will get different results.

Let me give you a very simple example which all can understand. In the fall you burn the leaves in your yard. If it is burning on top of those leaves, no smoke. If there are few leaves put on top, you get a lot of smoke. If you dump leaves all over it, enormous volumes of smoke. Same in materials. How you burn the material determines what the gas generation is, the heat, the smoke and other items.

We did not have test methods to allow us to establish the standard.

In this time period we brought onstream the large scale fire facility. This is a full scale 133 vehicle in a large building where we can in fact put in six seats, two rows, three abreast, with interior cabin materials, we can create fires in there and burn them.

We can create it so that we can determine what are the characteristics of the fire. We didn't know what the characteristics of the fire were.

There are two or three different items that affect this. Is it a fire that originated and stayed within the cabin? Very few fires are. That is an extremely random thing. Is it a fire that, because of the crash, fuel tanks broke up, started burning underneath in what we call the pool fire, and fuel that came up and burned through windows or otherwise?

Ninety-nine-plus percent of fires come from that.

So we had to determine then the characterization of the type of fire and internally what happened to it. This, then, was the first time, that is we started running into this and into materials tests as a result of having this full scale facility. We encountered flashover. We did not anticipate that this would occur. Flashover, simply explained, is you get materials on the inside of a cabin hotter than it would ordinarily be, heat goes to the top and when you open the door and oxygen comes in or a window burns out or a side opens up and oxygen comes in, literally within a period of 2 to 4 seconds the entire upper side of the interior cabin is in flames.

It is that area we have directed our attention to, to get the people out before that occurs. Evacuation, then, is the No. 1 item. Anything that gives us another 10 seconds aids us. The addition of the new materials, seat-blocking layers, gives us about 60 seconds more before flashover occurs. You know that if you light a fire it burns upward. And as a result the heat goes up so that if you can stop the fire in the seats you have now decreased or delayed the possibility that the overhead panels will catch fire.

Therefore, the initial effort was obviously directed toward seats. If we can delay that we can stop the upper heat and therefore we have delayed flashover.

Out of this, then, came the materials testing which the subcommittee has heard so much about. When I announced then in the spring of this year at Mr. Glickman's hearings that we now had a standard and we had a test method for the first time, industry responded magnificently. We have received 192 different types of materials. For the first time we have a standard and test method to which we can address the materials.

In this same period of time, if I took the fire-resistant materials of 2 years ago these ran about 26 ounces per yard. Today about 6.5 ounces per yard.

Drastic savings in weight which obviously are beneficial as a result of only 2 years' effort.

From this then it became apparent not one of the polymides or the other materials could meet the total criteria of fire resistance, seat wearing, if you will, and low toxic fumes. We couldn't find a single one. The greatest item against us was they just wouldn't stand up under wear.

This then led us to go back to NASA, who did an outstanding job in helping take some of their materials and adapt them into the fire blocking layer technique. Once we identified this and proved it in the late winter of 1983, once I saw this I said I want you to go back and give me a little more data so I know the impact of this using various materials.

As soon as this was confirmed, in the spring I immediately issued a notice of proposed rulemaking.

I would like to compliment the subcommittee, but I must acknowledge the timing had really nothing to do with the hearings. This data was completed in February, I sent them back in March and April to get a little more data to substantiate it.

From this then, material tests and fire blocking layers, we have now developed the criteria which will lead us into the new cabin materials, the top part. All of this now was on fire blocking layers for seats. You recall I said seats are the place where fire is the greatest potential. If we can now prevent the top above from catching fire or delay it, we can further increase time for the occupant to get out.

In this same area, then, late in this time period, early 1981, we found there was a potential for terrorists using gasoline or some other liquid to hijack the airplane. We rushed on a crash program together with industry to find a way to come up with an extinguisher which would allow us to take care of it and ran a series of tests to take care of this inflight fire.

This led us into the 1211 Halon extinguisher which works quite well. Without any requirement, I called the chairman and president of the air carriers and said we have developed 1211, I want you to move on this as rapidly as you can because I think you need it, I am telling you there will be an order coming down.

The carriers responded immediately on their own and all of them, as the aircraft came in, started converting that fleet even in advance of a single document that was out by me.

This is continuing into our cargo compartment area. This has us concerned because of C&D compartments and what they carry. So we have again a full-scale DC-10 compartment now rigged out. We have been conducting actual tests. We put in a lot of luggage and other items you would normally find in such a cargo area and set it on fire and burn it and see what the resistance is of liners.

The purpose is threefold: develop new liner materials which will now start to be specified for cargo compartments; second, develop new ways in which we can sense smoke or incipient fires; third, is to develop an adequate fire extinguishing system which is not at one end of the compartment or the other, but, in fact, can put in enough to take care of extreme temperatures. Finally, we want this liner material by itself without anything else to have the physical capacity to offset the highest temperature which is allowed or would generate from the materials allowed in there. We don't allow hazardous materials which could generate extreme temperatures, like thermite and things like that.

This is about completed and it will lead to another program, the inflight smoke-venting program. We have a 707 fuselage now being outfitted so we can vary the amount of inflight venting by local seat area, by total content by using nitrogen and inert gases. We will be able to run various tests to confirm there are or are not ways to vent smoke inflight.

The immediate thought is to take in outside air, but if you are at 35,000 or 40,000 feet and you open it up you are going to get a rapid decompression. At the same time you may be pouring oxygen out into the cabin if everyone doesn't have the oxygen mask on, which presents a potential hazard.

How can you do this, that is, maintain the pressurization and keep it under control? This will be in the program for late 1983 and into 1984.

Finally, our cabin materials test criteria for all new interior materials will have been established. Out of this—I will show you in a moment how this comes about—we will have established a method whereby all new materials will meet an increased specification performance for fire resistance.

Going back over to the controlled impact test, this test plan has been initiated, the test aircraft has been delivered to NASA at Dryden. We have been working for about 2 years to lay out the impact scenario and develop the final test plan and install the experiments.

This is a full-scale 720 airplane which will be fully instrumented, it will have six different seats in it, some will face forward, some will face backward, and some will be attendant seats. In addition, every other window, for example, will be the new window with stretched acrylic on the outside and a new compound on the inside which appears to delay burnthrough for 3 or 4 minutes.

It will be completely by fueled with the new AMK fuel. The engines will be running and it will approach the ground at a prepared test site in which steel poles sticking up will start to tear the airplane apart on purpose.

We want to prove to ourselves that, in fact, the fuel will not burn when it crashes. We will also have dummies in many of the seats and we will be recording data. There will be literally thousands of data points coming out of it.

For the first time, we will have had a controlled impact literally starting to tear the airplane apart the way we want to, to get the loads and results of all the test procedures.

From the experiments which will be installed, we will do 30 hours of flying ahead of time to be sure we have the test program laid out; we will run the impact test and there will be an executive summary of this test that will probably come out in the late fall of 1984, could possibly go over to 1985.

At the present time, this is scheduled for July of 1984. It is paced by other items, making sure our fuel degrader and other items work. This is an extremely complex program to try to get all these tests to fit together and come out on time and for me to sit here and tell you it is going to be in July of next year.

But the fact is we laid out early in 1981, actually in late spring 1981, and developed through all of 1981, a formalized program to put it all together to give us the test results. It is, in fact, going to be proven by this demonstration in July of 1984.

In the evacuation area as I have indicated, we are concerned about all of the toxic gases including heat, CO, and effects of these, and during this same time period we developed aluminized slides. I have had people say "Why didn't you issue a regulation on that?" I didn't have to. All I had to do was cancel the old TSO and issue a new one which said any slide must now be aluminized.

That was the way you got around 1½ or 2 years of rulemaking so that I didn't have to issue a regulatory item or NPRM. I canceled the old TSO which allowed the slides to be made of old materials and specified the new aluminized materials in the new ones. Hence, not only do the new aircraft have them, but as the older aircraft come in under the normal overhaul, they are retrofitted. The slides have to be replaced, and, thus, aluminized slides end up in all of them. It is a way to get it in service faster.

Out of this program also came the simple human survival model. Now, that is a difficult thing to say, because what we refer to is how much of these toxic fumes and of what kind can a normal person take? It is very difficult to say. But we have to classify that in an effort to have material standards be effective and also to be responsive to what we have as responsibility to the traveling public.

For example, I will make one simple statement and later elaborate just a little more; what is the survivability of this individual in water? Since our entire subject has been on cabin safety, how it all goes together, at the same time what will happen when we get to water?

I will address that later.

From this we started running additional tests to determine, for example, irritant gas effects. For example, if we had gases come out—maybe a passenger died or was killed by one of the chlorine gases, or maybe he wasn't. But what is the impact of the gases that are not toxic? Say he doesn't die, but it degrades him to the point where he cannot find the exit, or cannot get the seat belt loose.

It was the irritant gases that had not been classified. Nobody had done work on it. In pursuing this and researching the literature we found that a proposed level of approximately 50 parts per million of acrolein would be lethal. It is a gas that comes out when you fry bacon in the morning. Out of this we find we have rodents and baboons that can take up to 5,000 and 7,000 parts per million and they are still functioning.

We found that the basic literature in this is incomplete. Some of it is in error. How do we respond to this then in determining what the standards should be since the basic scientific literature didn't treat it? We now have a large scale program underway using rodents and primates to help determine what this is.

Out of this then we will develop a final standard for human survival model for irritant gases and as you will see later on, in aspects of water and other areas, what it is we should be designing for. From this then we will have a materials test criteria to meet these needs.

Each of these, then, are directed towards a longer term program to come together in 1990 or 1995. If we can sit down and identify the points we are after and put a date on them, we don't have a plan, we are just running along the way. But we do have a formal plan addressing the major issues in this priority, get the person out first, evacuation.

Second, prevent flashover. Third and fourth, protect him in the seat as well as you can. I would rather be injured than be dead. At the same time, try to protect him from these other items, but meet the two primary requirements first.

Finally, in supporting systems—then I will put these together—upgrading the standards on tires and wheels. Tires, for example, they blow out. The aircraft took off in Spain, the nose wheel tire blew out. The standards for tires and wheels are such that, we were not sure that in all cases, not that they were not adequate, they were well designed. But can we make them better.

We have been active in a program at Wright Field in doing an evaluation of tires to see if we can predict fatigue of tires. If we can do that we can start to establish again a standard for when that tire has to be taken off. Now we can write a regulation. So we are very active with the Air Force in tire maintenance and wheel maintenance.

Further, out of this program, we have installed with SwissAir a device that the pilot can look at that will tell him the pressure in all of his tires. It will tell him if any is low. It works. From this, now, instead of him going down the runway with a lower tire because of low pressure there, and the low pressure tire is the one that generates higher temperature, now he will know before he goes down.

This leads to tire fatigue, and ultimately we will get to tire performance, in 1985. I want to emphasize I don't see in any way that we have a wheel performance problem but these items have been directed to the past. They have been reactive. What I am now trying to do is to get us pro-active.

We have before us, I have proposals on my desk for considerations of a further stretch of the upper deck of a 747. We would be looking at 850,000 pounds of takeoff weight. I want to start now taking a look at the critical items such as wheels and brakes. I would like to be able to look out to the future. So our program is directed towards an early 1984, through the year 1984 meeting the past needs and now starting to identify those items that will lead to the future so that we can in fact take a regulatory position that will affect what is coming out in the future.

I have used more time, I know, than you would like, but there is one item I would like to make on the chart and I will summarize then with two.

Throughout this chart you see green items with numbers. Every one of those is a piece of regulatory action. Every one of them. How did we get to that point?

To get to all this, and as the chairman noted, it seems we do more testing than anything else, these are the number of tests which we have had to conduct to give us this data base to be where we are.

Little items or items which may appear to be little, take a lot of test set-up. You must be in a laboratory, you must have instrumentation, calibrated, measured, you must have cameras and all the recording devides. So in each case, of course here are some I didn't put on there, but you can see in some cases 2,000 tests had to be run, 4,000 tests.

To be able to complete all of these tests, then, and arrive at the data which we need, is something which we have needed the test center for, but it just takes time.

Let me give you an example of one other item not even on here.

You noted that I mentioned cabin materials over here in a test criteria. From the 192 materials which have been presented to us, 90 have indicated they will pass the flame resistance test, only that one. To be able to test these, then, we will take five initially, these five will first go through a vertical Bunsen burner test. What I am talking about is just the preliminary correlation, so that we in fact have a solid data base. That is a 60 second exposure.

We will have 1 test, 3 replicates, 5 materials, that is 15.

The radiant panel test—it is not enough we put a fire under it and try to burn it, we have to put the material over and radiate heat against it to see at what temperature it will explode by itself.

Six of those, 3 of them, 18, that is 90—15 of those, excuse me.

The Ohio State University rate of heat release apparatus test says what is the rate of heat release when the material burns. Six test conditions, total 18, 90 of those, merely again to start the preliminary correlation.

The test on the flame spread apparatus, that is 50. Fifty on the material.

Cope calorometer, so we know what calories of heat are coming out and we have a standard

FM small-scale combustibility, that is 90.

Merely to establish preliminary correlation on those 5 samples we will have to run 425 tests. Then we can start full-scale tests on the samples. That is the problem we have in doing it in short order. It does no good to do a test if the data is not valid.

What has this all led to?

The final chart I have, Mr. Chairman, is the record we have achieved in this time period. Each of these are regulatory actions that have either been achieved or are in the process now of being finalized.

The tire, wheel, and brakes TSO, flight attendant seats, shoulder harness amendment came out in 1980; but since—look at what happened since 1981: Fire extinguishers, child restraint, tire maintenance, deicing procedures, life preservers, aluminized slides, and for example, let's take that one, one of the items we are looking at is, can we modify the aluminized slide so if the aircraft goes down in water it will automatically separate and since it is inflated anyway, it is an additional life raft.

We should have thought of it a long time ago, but we didn't. We didn't until we organized the formal program to address survivability in the various modes.

The crew protective breathing TSO was out in June.

Fire-blocking layer, cabin emergency lights, the cargo compartments, NPRM is in final preparation; fire extinguishers and smoke detectors, out in November; crash resistant fuel systems, human tolerance—the list speaks for itself.

So that I do not believe that the FAA has overlooked or not taken regulatory action. Once we got our formal program pulled together with schedules and got the full fire facility underway so we could in fact approach these problems knowledgeably, to me we have moved out rather aggressively.

I would like to mention one other item, Mr. Chairman, and then I will be glad to pause for questions.

I said earlier that in consonance with what the committee was doing, we have addressed today just cabin fire safety and those things that go with it.

Mr. LEVITAS. Excuse me, Mr. Helms. I am just trying to digest that chart there.

The one you described that I don't see listed there—maybe something is blocking it—I see it. It is the interior materials. Is that the development of a regulation on standards?

Mr. HELMS. Yes, sir.

Late in 1984, after we—first, we concentrated on seats.

Mr. LEVITAS. I understand. I have some questions on that.

I just want to be sure it is on there some place.

Mr. HELMS. What I have summarized today is primarily cabin interior, cabin survivability, fire, what we can do to prevent it.

At the same time, after looking at this and looking at the survivability aspects I directed on July 16, 1981, the office of the Director of Airworthiness sent a directive through to the Federal Air Surgeon to develop a formal plan towards water survival research.

This plan has been underway and I noted that the program should cover the full range of issues and options of postcrash survivability and tradeoffs.

A protocol was developed and the program was initiated and funding was obtained in April 1982.

I won't go into it in great detail, but I will address the eight areas of this program so that the subcommittee can see it is not just cabin safety. It is part of an overall program of improving safety for the air traveling public.

First, it is donning time for life preservers. What can we do to reduce that time?

Two is storage location and accessibility of these life preservers.

Three, concepts for improved types of life preservers.

Four, slides or rafts for narrow bodied jet aircraft. For example, we have found that a life may not be the best item. A device which we call a life platform, if you will, has been under test for some months at CAMI. It appears to offer some benefits.

Conventional rafts versus the NASA design.

Concepts for unconventional raft or floatation platforms.

Open water performance test.

Physiological effects of immersion hyperthermia. These are all items that are put together to try to address this question of water survivability.

But the first item I will acknowledge was in cabin fire, getting it organized, pulling a program together, and starting to address these issues in a formalized way.

I will not dwell on the other items inasmuch as it was cabin safety you were primarily interested in, but I didn't want to leave the subcommittee with the idea we were only addressing one item and that one alone.

Water survivability is getting underway and seems to offer promise for the future.

Now, Mr. Chairman, we will try to answer questions that you may have.

Mr. LEVITAS. Thank you, Mr. Helms. This went longer than I expected it to, but because I wanted this subcommittee to be fully informed as to your view of where you are and where you are going, I feel it is worthwhile to make the record on it.

Mr. HELMS. I apologize for overrunning my time, Mr. Chairman.

Mr. LEVITAS. That is all right. Just a couple of preliminary questions.

You made reference in your testimony to the work of CAMI and the respect in which CAMI is held by the industry.

We have heard reports that there is some plan afoot and consideration being given to abolish CAMI. I would like to find out if that is the case?

Mr. HELMS. No, emphatically not.

I never even considered a plan for abolishing CAMI. I have, however, been, I will say, not concerned, but it is my responsibility to ensure that the taxpayers' money is used to the best extent possible so I had a little concern that we were overlapping areas of research with the CAMI of the Air Force and also with the Navy.

I did visit them and talked to them to be sure we were not overlapping. To that extent, some functions may have been slightly reduced because we can do it in other places as well.

There has never been any intent to abolish CAMI, sir.

Mr. LEVITAS. One of the criticisms that I have made of FAA's management of its safety responsibility, particularly in the area of cabin safety, relates to the fact that it seems to take so long and it is usually too little and too late.

We all know—looking at the statistics—that literally hundreds of commercial air passengers have perished in survivable accidents. They survived the crash or the incident only to lose their lives in postcrash phenomenon, whether it is dying from a fire, smoke inhalation, or toxic fumes.

You know the statistics better than I do.

Now, I look at that item there, interior materials, which is a major contributing factor both to the fire and to the toxicity and to the smoke, and you are proposing a notice of proposed rulemaking in late 1984.

It is my recollection that the first proposed rulemaking that related to this matter, since the establishment of the present rules, goes back more than 12 years, maybe even more than that.

It is about 12 years. A dozen years.

In the meantime, there have been hundreds of people who have lost their lives as a result of less than the state-of-the-art interior materials.

Now we are looking at late 1984 for a notice of proposed rulemaking.

What I have said up to this point is purely factual. It is not a question of judgment. There were proposals, they were put forth, they were withdrawn, they were—we had something called the Safer Committee. That came before your time.

Mr. HELMS. Yes, sir.

Mr. LEVITAS. And in the course of your testimony on page 8 and 9 you indicated that the industry has never appeared to be recalcitrant or reluctant to go forward.

Well, the Safer Committee was a device created by industry at the proposal of a particular vice president of a major airframe manufacturing company—I won't name the name here today—who called on the telephone and spoke to FAA just before the regulations were to be issued, and said, "Look, instead of having these rules issued, why don't we have a Safer Committee," and sure enough, there was a Safer Committee. I remember very well, Mr. Helms, shortly after you became Administrator, you had a very interesting seminar, I guess, a symposium, whatever, over at the Sheraton/Carlton Hotel and people from the industry and airline pilots and general aviation and others came and we sat around the table. I must say I left that discussion with a very definite feeling that the industry was going to do what they were going to be required to do and they are not going to do that very expeditiously.

This is in the aftermath of the Safer Committee which resulted in another delay.

Twelve years later and we are still looking at a proposed rulemaking late 1984.

Why does it take so long and why are lives lost in the interim?

Mr. HELMS. You pose a number of questions and certainly valid ones.

I noted that it was not until late 1981 and during 1982 we were able to confirm the phenomena of flashover, so the committee chairman used the term state-of-the-art materials, I think. These are the materials that I have here which have been used for the last 15 years, the last 10 years, and the last 5 years, that represent the absolute latest state-of-the-art, 767, 757, A-310.

This one—I have to hold it with tape because it has a human element there, little pieces of fiber come out and stick you in the fingers—is a prototype that appears to be better. None of these existed in that time period, Mr. Chairman.

The prior ones before had gases. They also did not have protection against the flashover.

Mr. LEVITAS. Are those being used now?

Mr. HELMS. Yes, sir, this is the standard right here. The standard, one of the latest.

Mr. LEVITAS. My point is—and I want you to address this because I am talking about FAA's role in this and the fact that industry responds when FAA speaks—it is my understanding that that material exceeds the requirements and standards that are now in place for materials.

Mr. HELMS. The problem that I tried to allude to, Mr. Chairman, was that we did not have a test method and a standard. We could say a temperature at which maybe it didn't ignite; we could say it didn't burn at such a rate, but as a result of the test program we have found, first, of course, that any material will burn, and second, depending on the way it is burned, you get different fumes and gases and smoke.

It was not until we developed this test method which came out in the last 2 years that we can now properly define to the industry what it is we must have.

Now, as the samples start to come forward, we will test them to be sure they meet them and that is the reason it is going to take us until late next year to complete those tests.

Most of the tests will be conducted through the spring of 1984, and the data will be analyzed in the summer, and the schedules that I have outlined and the progress I have made on making regulatory actions has not been too bad in 1982 and 1983. So I have a high confidence we will make that in 1984. But I cannot account for the past years.

We just learned more about it. Now we are finally putting that data base together.

Mr. LEVITAS. I am not simply suggesting that you ought to say this didn't happen on my watch and look what happened since 1981——

Mr. HELMS. I would not say that, Mr. Chairman. It has been my watch; it has been for 2½ or 3 years.

Mr. LEVITAS. My point is, I see FAA regulating after long delays which I think could be avoided and behind the state-of-the-art.

That is what concerns me. When I look at this history and I go back, I have here hearings that this subcommittee held in 1976, 1979, 1980, and we were talking about the same things then.

Now, 1980 to 1984 is possibly a reasonable period of time, given the complexity, but I am looking not at 4 years, I am looking at 12 years and that is where my concern arises.

On July 19 Congressman Molinari and I wrote you a letter following the first 3 days of hearings, and I am going, without objection, to request that the letter we wrote you and your response to us—looks like September of this year—be made part of the record.

[The letters referred to follow:]

COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION,
Washington, DC, July 19, 1983.

Mr. J. LYNN HELMS,
Administrator, Federal Aviation Administration,
Independence Avenue, SW., Washington, DC.

DEAR MR. HELMS: Last week we held three days of hearings as the first phase, this year, of our inquiry into FAA's dismal record of managing its air safety responsibilities. This set of hearings is a continuation of the oversight of FAA's safety program which has been on-going for at least nine years. Unfortunately, the hearings we have just held revealed the same types of problems at FAA and in air safety that we saw nine years ago.

You must be aware by now of the disappointment we have expressed publicly for the manner in which the FAA has managed the particular category of cabin safety. We intend to resume these public hearings at the earliest possible date and once again, publicly to discuss these very advanced and sophisticated materials which we know are presently available for installation in all commercial aircraft. It's our firm belief that the only thing lacking is an FAA regulation to require their use.

But even before we get to these materials, it's very obvious there are things which the FAA can do and should be doing right now to promote a safer environment in aircraft cabins.

At the very least, you ought to consider the immediate issuance of rule making proposals in the following areas:

(1) The installation of smoke and fire detection devices in all commercial aircraft, especially in aircraft lavatories and places adjacent to the passenger cabin where an electrical short or other cause could lead to ignition.

(2) A prompt FAA investigation into the reasons why something has not been done with the recent tests conducted on the flight deck crew's emergency protective breathing equipment for the 757 and 767 aircraft. Our information is that this equipment, which has been certified by the FAA for use on the above aircraft was tested at CAMI, and leakage was found. Given the difficulties encountered by the pilot of the Air Canada DC-9 at Cincinnati last month, it seems incredulous that this matter is not receiving the highest priority at FAA.

(3) Testimony during the hearings and our own staff investigation clearly shows that evacuations are critical to situations where an aircraft has to make an emergency landing, and yet, we continue to receive testimony that exceptions to regulations requiring carriers to demonstrate their capability to evacuate an aircraft within 90 seconds are being granted automatically. For example, the matter of Peoples Express being granted an exemption from such requirement because they leased the aircraft from Braniff International, which had demonstrated they could successfully evacuate the aircraft, is most disturbing.

(4) While we have no interest in any one particular product, we are interested in the availability of technology that is available to save lives which FAA ignores. We listened to a witness describe the frustrations he has encountered in attempting to persuade the FAA that protective breathing devices are available which quite possibly could have saved the lives of the 23 victims of the Air Canada accident. He showed a videotape of the device, which is easily donned, and has the added capability of being connected to the present fresh air supply of commercial aircraft, providing an unlimited time for a passenger to breathe in a smoke filled cabin in the event of an in-flight fire or explosion. FAA was supposed to be studying this approval for years now.

We are aware this matter has been researched, tested and discussed at FAA for too many years, and we cannot understand the attitude of the FAA in not being out front on the requirement for installation of some protective device of this sort. All the arguments we have heard over the years simply do not justify what took place during the descent into the Cincinnati airport.

In closing we want you to know that we realize you inherited these problem areas, that you are interested in air safety, and want to do what is right. However we do not think your agency officials, who have responsibility in these matters, understand that the clock has run out on their procrastination. We intend to move ahead on these critical issues, and while we would hope FAA could respond to our concern, history has taught us some bitter and costly lessons in air safety.

When you have had an opportunity to digest the views expressed herein, we would appreciate hearing from you.

Sincerely,

GUY V. MOLINARI,
Ranking Minority Member, Subcommittee on Investigations and Oversight.
ELLIOTT H. LEVITAS,
Chairman, Subcommittee on Investigations and Oversight.

U.S. DEPARTMENT OF TRANSPORTATION,
FEDERAL AVIATION ADMINISTRATION,
Washington, DC.

Hon. ELLIOTT H. LEVITAS,
Chairman, Subcommittee on Investigations and Oversight,
House of Representatives, Washington, DC.

DEAR MR. CHAIRMAN: This is in reply to your letter of July 19, cosigned by Ranking Minority Member Guy V. Molinari, concerning hearings held during the week of July 10 by the Subcommittee on Investigations and Oversight.

In regard to the particular regulatory recommendations expressed in your letter, the following activities are in process or have been completed. (Subject areas are enumerated as in your letter.)

"(1) The installation of smoke and fire detection devices in all commercial aircraft, especially in aircraft lavatories and places adjacent to the passenger cabin where an electrical short or other cause could lead to ignition."

Several years ago, the Federal Aviation Administration (FAA) issued a series of airworthiness directives designed to correct deficiencies in cabin lavatory fire protection. These airworthiness directives required inspection and repair of lavatory electrical components and trash receptacles and were considered sufficient to assure an adequate level of fire protection. We currently are conducting an inspection survey of aircraft lavatories to determine whether the airworthiness directives have served their objectives. Preliminary results plus recent inservice incidents indicate that additional fire safety measures may be necessary. We are developing, on a priority basis, a Notice of Proposed Rulemaking (NPRM) to require the installation of smoke detection systems and other fire protection measures in lavatories and galleys.

The Federal Aviation Regulations (FAR) contain design requirements for the use of automatic protective devices to protect against electrical shorts. However, if these devices are overridden by crew aciton in the event of a continuous fault, such protection will be lost. It would be impracticable to install smoke detectors in all areas where electrical shorts could occur if the protective devices are overridden.

"(2) A prompt FAA investigation into the reasons why something has not been done with the recent tests conducted on the flight deck crew's emergency protective breathing equipment for the 757 and 767 aircraft. Our information is that this equipment, which has been certified by the FAA for use on the above aircraft was tested at CAMI, and leakage was found. Given the difficulties encountered by the pilot of the Air Canada DC-9 at Cincinnati last month, it seems incredulous that this matter is not receiving the highest priority at FAA."

On April 27, 1982, prior to certification of the Boeing 767, the FAA Seattle Aircraft Certification Office advised the Boeing Commercial Airplane Company of the certification basis for protective breathing equipment for the airplane. That certification basis consisted of compliance with the Society of Automotive Engineers (SAE) Aerospace Standard (AS) 8031, dated June 1980, or compliance with the CAMI criteria. During the type certification process an administrative oversight occurred which resulted in this equipment being installed. Corrective action has been initiated to require replacement of the equipment with an acceptable design.

On June 27, 1983, the FAA issued Technical Standard Order TSO-C99, which establishes minimum performance standards for emergency equipment that will provide flight deck and cabin crewmembers with eye and respiratory protection during in-flight emergencies. TSO-C99 incorporates SAE AS 8031 by reference. The equipment will assure the wearer of protection against an oxygen deficient, toxic, or highly irritating environment, e.g., smoke. Respiratory and eye protection will be provided in a manner which does not compromise the user's ability to perform his/her required tasks. We also have a priority rulemaking project in progress that will require the installation of protective breathing equipment meeting the TSO-C99 standards or equivalent in Part 121 air carrier aircraft.

"(3) Testimony during the hearings and our own staff investigation clearly shows that evacuations are critical to situations where an aircraft has to make an emergency landing, and yet, we continue to receive testimony that exceptions to regulations requiring carriers to demonstrate their capability to evacuate an aircraft within 90 seconds are being granted automatically. For example, the matter of Peoples Express being granted an exemption from such requirement because they leased the aircraft from Braniff International, which had demonstrated they could successfully evacuate the aircraft, is most disturbing."

We would like to correct some misconceptions regarding the evacuation tests. Presently, FAR 121 291 requires an operator to perform a full-scale demonstration, completely evacuating the full-seating capacity of the aircraft in 90 seconds, using only half of the emergency exits; if the airplane type and model have been demonstrated for that total number of passengers, the operator may elect to conduct a partial demonstration of the emergency evacuation procedures. The purpose of a partial demonstration is to demonstrate the effectiveness of the crewmember emergency training and evacuation procedures being utilized by that operator; 50 percent of the emergency exits and evacuation slides must be made ready for use within 15 seconds.

The 15-second time requirement imosed by this rule is very difficult to comply with, because not only is it a very short period of time to complete the test, but all selected items of emergency equipment must meet these time requirements. This is not true of the full-scale demonstration, which allows for failure of equipment as long as all the passangers and crewmembers leave the aircraft in 90 seconds or less.

People Express Airlines was not granted an exemption from the emergency evacuation demonstration requirements stipulated in FAR 121.291. People Express conducted a partial evacuation demonstration on its B727-100 aircraft on June 13, 1983, and on its B-747 aircraft on May 16, 1983. These demonstrations were conducted in full compliance with FAR 121.291 and were successfully completed. Both crewmember emergency procedures and emergency equipment were tested.

"(4) While we have no interest in any one particular product, we are interested in the availability of technology that is available to save lives which FAA ignores. We listened to a witness describe the frustrations he has encountered in attempting to persuade the FAA that protective breathing devices are available which quite possibly could have saved the lives of the 23 victims of the Air Canada accident. He showed a videotape of the device, which is easily donned, and has the added capability of being connected to the present fresh air supply of commercial aircraft, providing an unlimited time for a passenger to breathe in a smoke filled cabin in the event of an in-flight fire or explosion. FAA was supposed to be studying this apporoval for years now."

The FAA has not ignored available passenger protective breathing technology. CAMI has conducted many evaluations over the years on various devices, including the device described by your witness. The industry respects highly the opinion and expertise of CAMI in the area of protective breathing.

On the general issue of protective breathing equipment for passengers, besides the fact that there are some serious technical deficiencies in devices on the market which claim to provide protection from smoke and toxic gases, the basis issue is whether or not the FAA should regulate and mandate such devices. The FAA is or will be taking action in many areas that will improve survivability in the cabin, some of which are: (1) issuance of an NPRM on seat cushion fire blocking layers; (2) issuance of an NPRM on low-level emergency lighting; (3) issuance of an NPRM on installation of smoke detection systems and othe fire protection measures in lavatories and galleys; (4) issuance of TSO-C99 establishing requirements for protective breathing equipment; (5) issuance of an NPRM requiring protective breathing equipment meeting TSO-C99 on Part 121 air carrier aircraft, and future changes to make Part 25 protective breathing equipment requirements consistent with TSO-C99; (6) issuance of TSO-C99a requiring, after December 3, 1984, newly manufactured airplane slides to have imporved fire protection (7) establishment of a rulemaking project to specify improved fire protection criteria in Part 25 for cargo compartments, as a rusult of recently completed research at the Technical Center; (8) research on methods to improve the flame hardening and reduce smoke and toxic gas emissions from cabin sidewall and overhead panels; and (9) research on methods for evacuation of smoke from cabins should a fire occur. All of these efforts show a dedicated effort by this agency to markedly reduce the fire hazards on aircraft. We do not find a need to provide protection for passengers beyond the oxygen masks presently provided for rapid decompression and intend to take no action on requiring or developing passenger protective breathing devices. We are focusing our efforts on methods of fire-hardening the aircraft, providing the crewmembers with protective breathing equipment and Halon fire estinguishers to fight fires if they should occur, and advising the air carrier crews of the importance of reacting quickly to suspected fires and not ignoring safety features such as circuit breakers. These efforts are sufficient, we believe, to provide the level of safety as envisaged in the FAR, without entering the arena of passanger fire protection measures, such as protective breathing equipment.

Concerning your witness, the requirements for obtaining FAA approval of his device were explained to him as early as September 1981. These requirements include the submittal of design and test data to substantiate compliance with the applicable airworthness standards. To date, such data have not been submitted to the FAA for evaluation. The FAA will review the substantiating data if your witness applies for approval of the protective breathing device, but until he provides the data we can take no further action for approval of the device.

At the forthcoming hearing of the subcommittee, FAA will give a more detailed briefing of our activities concerning improvements in cabin fire safety.

Sincerly,

J. LYNN HELMS, *Administrator.*

Mr. LEVITAS. I want to ask you questions about that.

Mr. Molinari and I, following the hearing received some rather disturbing testimony about what was going on, and this was coincidentally just in the aftermath of the Air Canada tragedy, suggested that some immediate action be taken on the number of items which we felt could be done without a great deal of difficulty or delay.

One of them was installation of smoke and fire detection devices, especially in aircraft lavatories and places adjacent to the passenger cabin where an electrical short or other cause could lead to ignition.

Your response, and your testimony today is, you have indicated developing on a priority basis a notice of proposed rulemaking to require installation of smoke detection systems and other fire protection measures in lavatories and galleys.

However, you go on to say that it would be impractical to install smoke detectors in all areas where electric shorts could occur if the protective devices are overridden.

You had previously talked about how the pilot can override the circuit breaker or other means.

My question to you is, what is the impracticality involved? Isn't it really more important to put a smoke detecting device, which is a very relatively inexpensive piece of equipment, in an area where the pilot can override the protective device in order to let him know, look, you have overridden the protective device and you got a fire.

Isn't that the most sensible place to have a smoke detector so that the pilot can know that his action was counterproductive and that he better do something else because he has got a serious problem developing?

Mr. HELMS. Mr. Chairman, let's consider any large aircraft of the wide-body class. There are literally tens of thousands of miles of electrical wire in that airplane all the way through.

As we go from what we refer to as bulkhead to bulkhead, which is a strengthening piece within the structure of the airframe and running the full length of the airframe in many cases, and truly the full length throughout the airframe down underneath are just literally thousands of miles of wires and there are areas between one bulkhead and the next in which you would have to put a smoke detector in every one of these areas around every wire throughout.

There would be hundreds of them.

So I don't know how to do it. We can put an alarm device there, but I don't know how we would do that. We would be better off spending our time to be sure that we reduce the voltage level in that wire to the point where we can use a lower voltage circuit breaker so when it popped we didn't put enough electrical energy in to create the fire.

Mr. LEVITAS. Mr. Helms, aren't there places in the fuselage of the plane where the systems—where these circuit breaker protective devices are built in which are not accessible and where fires or shorts can develop so that if you had smoke detectors in those areas they would tell the pilot that he has a fire?

Mr. HELMS. We require as part of our FAR Part 25 regulations that the circuit breakers be accessible to the flight deck crew which may either be the pilot, copilot or flight engineer, for any item which is necessary to operate the aircraft safely and be able to maintain integrity.

So that the problem is not the circuit breakers, Mr. Chairman. The circuit breakers will pop. The problem is in the wiring. If a piece of wire rubs against a bulkhead and the insulation comes off, now we have a potential short, or where a wiring bundle comes together which could be buried anywhere in the aircraft. That is where the fire would start; that is where the short would occur.

The circuit breaker is an indication to the crew that something is wrong. The thumb rules which we have learned over the years, if the circuit breaker pops, never hold it in. If you want to verify it was not a random failure, push it in and take your finger off immediately. If it pops back immediately, you know you've got a problem. If you try to push it in and hold it, all you have done is create an electrical circuit wherever the short was and you are about to get a fire.

So the warning system, alerting system to the pilots and crew is sufficient now. But I don't know how we would put smoke detectors throughout the entire fuselage and wing structure every place there is electrical wiring in the airplane.

That type of short could occur anywhere.

Mr. LEVITAS. I just have a couple other questions for now, so my colleagues can ask questions and I will get back to my remaining ones later.

Let me talk about evacuation for a moment. One of the items not listed as part of your procedures there and work which I believe is critical is the role played by the flight crew, and the flight attendants. They are absolutely essential, it seems to me, to safely and quickly evacuate an aircraft.

We have had testimony, rather dramatic testimony, from professional flight attendants who have been highly critical of their lack of training, their lack of recurrent training, their lack of adequate familiarization with new aircraft which are coming into their particular fleet and the fact that they are given, zero hands-on experience in fighting fires.

Zero. They were given textbooks to read from and little pneumonic poems to recite and things of that sort.

Now, why is there not a greater emphasis placed by FAA on requiring and seeing to it that adequate training is given to flight crews for purposes of fighting on-board fires or evacuation because I have sat in and watched some of these training courses, Mr. Helms. I will tell you that when they explain how you evacuate a plane they have classrooms, they explain it, they go to the mock-up and they have four people work it out of the whole class. Two of them run the slide at the top, two at the bottom, and the rest of them are passengers jumping off the plane.

That, to me, is not adequate training.

Why doesn't FAA put on that chart and get tough about certification of adequate training for flight attendants?

Mr. HELMS. Certainly the cabin attendant's profession is one that is probably the leading group as regards cabin safety for the passengers. It is a very professional capability. My impression is that there is a required annual training, not just an initial one when they go through and become classified or authorized and certified as a cabin attendant, but they undergo annual training.

I have seen some videotape films which are additional training devices. Recently we explored the possibility with two or three contributors, I am told it is now underway, towards developing a fire extinguishing device which is a replica of the Halon 1211 and uses a CO_2 cartridge. So you can give them the opportunity to have the full hands-on training, but it is not available now.

I don't know what the time period is, but I am sure it will take some months to develop it and get it underway. I am under the impression that annual training is required, however. I think I would ask the Deputy Associate Administrator for Aviation Standards who has been at this business far longer than I, Mr. Broderick, to answer if I am in error.

Mr. BRODERICK. No; you are not, Mr. Helms. We do require, specifically, Mr. Chairman, hands-on recurrent training in terms of opening emergency evacuation doors. I can't understand how you could have been in such a class and seen what you describe.

I think what might have happened is that there are a number of different kinds of training courses given for different purposes. You probably were not in a class wherein the people who were getting that required training were being checked off on it because that would in fact be a falsification of records if that were the case.

Mr. LEVITAS. Mr. Broderick, did you read the transcript of the last 3 days of hearings on this subject?

Mr. BRODERICK. I have not seen it, sir.

Mr. LEVITAS. Let me urge you to do it because we had, as I recall, three or four flight attendants with a great deal of experience who care a great deal about their job and are professionals and you read their testimony.

Mr. BRODERICK. I will be happy to.

Mr. LEVITAS. Then after you have done that, you will understand what you think is happening and what is really happening could be two different things.

Mr. HELMS. I have found them to be a very responsible group, Mr. Chairman, and very interested in training and everything else that will aid them in learning how and being able to implement additional cabin safety.

Mr. LEVITAS. Mr. Broderick, what about the use of the fire extinguishers? We received testimony there was no hands-on training in the use of fire extinguishers.

Mr. BRODERICK. I think specifically that may be precisely accurate.

As Mr. Helms indicated, we have one of the regulations that is up there that will correct what amounts to a loophole in that we do not require discharging of the fire extinguisher now.

We do require hands-on training. You must handle it and see how to work the trigger and how to work the nozzle on it. As you know, there are different kinds, depending on the make and model.

We are now in the final stages of writing a regulation which will be out this year which will require actual use of the kind of fire extinguisher that they would be qualified on, sir.

Mr. LEVITAS. I will tell you what I will do. I am going to hold off on any further questions until you have had an opportunity to review that testimony because my judgment is that the flight attendant is critical to the safety evacuation.

I am going to raise the question again on the matter of protective breathing devices. It is bad enough for a passenger to be incapacitated, but if you have your flight crew incapacitated, the likelihood of getting out of that aircraft for everybody is tremendously diminished.

Mr. BRODERICK. We will be happy to work with committee counsel and get a copy of the transcripts.

Mr. LEVITAS. I have a series of questions on the protective breathing device question and I will get back to that on my next go-around.

In the interest of time, I will ask Mr. Molinari at this point if he has any questions.

Mr. MOLINARI. Yes, I do. Thank you, Mr. Chairman.

Mr. Helms, let me start off by saying that I was very much impressed by the presentation that you gave to us today and the personal knowledge that you have exhibited towards the various tests that are described up there and the regulations that are in the process of being adopted or suggested.

Which leads to my first question:

The chairman made reference to a letter that we both signed that was addressed to you and was dated July 19, 1983. We received a response, at least Mr. Levitas did. Do you know the date that that response was sent out?

Mr. HELMS. It was in September. I can't recall the exact date. September 27, Mr. Molinari.

Mr. MOLINARI. Is it a policy of your office not to date outgoing correspondence?

Mr. HELMS. No, sir, as a matter of fact, that would be an aberration. We always, under normal routine, date outgoing correspondence.

Mr. MOLINARI. This one is undated and I had it checked to see when it came in because there is no indication that a copy was sent to me.

It may be that one was and I didn't receive it. The question that comes to my mind is with the scope of knowledge that you demonstrated to us today, why would it take you 2½ months to respond to a series of questions that were of a very serious nature posed by the Chairman and ranking member of this committee?

Mr. **Helms**. Well, there are many reasons which go into the demand for the Administrator's time, but in this particular case I had two other concerns.

One was what type of extinguisher. Where should it be located? How would we put it near where the "bad" fires are which are the electrical fires?

What is the tradeoff between the options of a fire inside the compartment of waste material which, by the Federal Air Regulations should be designed to where it contains the fire?

What type of sensor elements can we put in to give us sufficient reliability, particularly when we have an aircraft of 747 size which has many of these in it?

So it took time to sit back and look at it and say that the probability of fire is greater in the waste disposal area but the intensity or danger or potential danger of the fire is greater in the electrical circuits in the flushing mechanism.

Now, what impact is it going to be whether we specify where that is, what is the cubic volume of all these lavatories so we know how many extinguisher components have to be put in?

It just took time to look at it and see.

As a result of that, once we had looked at it and said we can take a look at it and examine it and see what tradeoffs we could find to reduce the number of options, it went by 90 days or so, had gone by.

I think your letter was dated about 90 days before our response. Since then we have, of course, moved out and we are in the final stages of the regulation now.

Mr. **Molinari**. I understand that and I understand there are other recommendations that you are about to undertake.

I am pleased to see that, but to recognize it took so long, I wonder whether that is symptomatic of the problem.

To turn from that, I had not read your statement when I made my introductory remarks. I had been away for the weekend and I just returned and was unaware you had addressed the problem of polymide in your statement.

I can't say that I disagree with some of the basic tenets that you have in there and the question of cost/benefit analysis. I don't think anybody really would suggest that a rule be adopted that would cost the kinds of moneys that you have laid out here on pages 3, 4 and 5.

If you look at page 3, towards the bottom, you talk about materials that would reduce the level of toxic gases, the indication I have is that polymides was, to your knowledge, the first material to address that problem. Is that a correct interpretation?

Mr. **Helms**. Depending on what you mean by address the problem. The polymides release, I am going to say an acceptable level of toxic fumes. All of them have some, and our problem was we didn't have a human tolerance model but they are, I am going to say acceptable, but under certain conditions that would not be true.

Generally, for our discussions it has an acceptable level.

Mr. **Molinari**. Again, not to press the issue too much, but just from my own information, polymides which came out roughly 3 years ago, the indication I have from your testimony is that that is the first time there was any material suggested that would address this problem of toxic gases.

I am wondering if that was what you intended to say?

Mr. **Helms**. No, sir. I have led you astray then. There are various materials that could have an acceptable level of toxic gases, but they may not have an acceptable level of irritants.

Mr. **Molinari**. This is the first material that tested out with acceptable levels?

Mr. **Helms**. It was the first one that had acceptable levels of toxic fumes which could become lethal which had a satisfactory irritant level, and which had the flame resistant products. Those three combined. Where it failed was on the wear.

Mr. **Molinari**. OK. Are you aware of improvements that I alluded to in my opening statement.

Mr. **Helms**. I don't know that I know all of them. The one I am most familiar with is the work done out in San Diego; a firm there specializes in polymides. We have reviewed that as late as within the last 90 days.

We still don't have a material that will meet the wear test. We can find a number of materials now compared with the 3 years ago when they were introduced, for which, we can find an acceptable level of toxic fumes and an acceptable level of the others, but we have not found one that can meet the wear test.

Now, since I testified before Mr. Glickman in the spring and noted we now have a test method and we now have a standard out, of the 192 materials we have received, 92 have very flame-resistant capabilities, but we have not completed testing of those so it may be within those, there may be some more, but I can't say as yet.

Mr. **Molinari**. In your R&D, did anybody take a look at the potential of improving on the polymides material?

The reason I ask, in looking back to the press release put out by NASA when they first developed the material, first announced the development of this material, they were probably overly generous in their definition of what this material would do but nevertheless some of us have a very high opinion of NASA and the materials they have developed.

So, to me it at first blush looked very promising. The question I have then is would you not have taken this material and sent it to some unit within your jurisdiction and asked them to see if there is some way that it could be improved upon and made acceptable from the durability standpoint since it seemed to possess all the other qualities?

Mr. **Helms**. In the area of research materials, we looked to NASA. They are the epitome of a research organization that far exceeds anything we can do in FAA. Once the results of their work are known, such as this, and it can be converted into a woven material for use, then we will have in this case, for example, usability tests done.

Boeing, McDonnell-Douglas or one of the others will set up a test rig and run this rig over and over and over again to see how long that piece holds up for wearability.

They are better prepared or better facilitized to do that than would NASA and the three, NASA as an organization of the Government and ourselves and the industrial base work hand-in-hand.

We are all after the same thing, so we look to NASA for new materials; if we hear of one from somewhere else, we will send it to them, ask for analysis, tell us what the properties are. The fundamental research of materials is done for us by NASA.

Mr. MOLINARI. Apparently they were over the mark with reference to this material.

Mr. HELMS. No, sir, for their uses they were right on. If you stop and think about it, the average mission during that time period, Apollo, Gemini, Mercury, they didn't last very long. There are no reuses of Apollo capsules, Mercury, or Apollo capsules.

Mr. MOLINARI. I am not talking about their use of the material, but their press release, where I specifically recall that they made a very strong recommendation that consideration be given primarily for the use of that material in commercial aircraft.

Mr. HELMS. We did do so. Once we found it met the flame resistant characteristics, met the toxic gases, met the irritants, it failed on the wearability test. That took us a while.

Mr. MOLINARI. So they were off the mark in their statement? Their recommendation that the material be considered for use?

Mr. HELMS. I don't think they were off the mark. It was proper that they recommend it, but they had not tested wearability.

Mr. MOLINARI. I understand that. My real concern is this: We are not talking about an interagency memo saying, hey, we have got something here you might want to look into, but instead they chose a system of issuing a formal press release which was disseminated throughout the world probably and when we had NTSB before us, they had no awareness of the material at all which raised concerns in my mind as to—we had three of their top experts—if they didn't know about it, it seemed we had some problems in the system.

What is the——

Mr. HELMS. Excuse me, Mr. Molinari. You mean this sample?

Mr. MOLINARI. I wanted to ask the question on that last one. Describe that. I missed what you said about that.

Mr. HELMS. In direct response, I mentioned the problem we had with it was in wearability. People sitting on it sliding back and forth.

Mr. MOLINARI. I understand.

Mr. HELMS. Which broke down the cellular molecular construction. The use of polymides in a honeycomb which is this one, it is in the cabin constantly, this is the NASA advanced panel and they were exactly right.

So this is the most representative panel we have of the next generation coming along.

This will be confirmed in the test programs and the use of polymides will probably be—I don't want to be too conclusory at this point—it will probably be the basic material that will be used inside which is the polymide honeycomb.

Since it is rigid and by itself, it can be formed and does not have to have something rubbed against it, so it is excellent. NASA was right.

Mr. **Molinari**. So we are learning that the material suggested would be permissible for and advisable for certain uses in the plane where you don't have the wear and tear.

Mr. **Helms**. Yes, sir.

Mr. **Molinari**. The question I would have to ask then is, why did it take so long to make that determination and how long will it take—we are talking about 3 years now since they first announced it.

For the first time we are being told that there is consideration of using it in other areas except for the wear and tear areas in the seat.

Why does it take so long to get that together? Give me an estimate of how long it will be before that is installed in the aircraft given the best of circumstances from this date on.

Anybody?

Mr. **Helms**. I would hazard a guess that for production line aircraft it would probably be 5 years.

Mr. **Molinari**. We are talking about 8 years from their announcement for the materials first appearing?

Mr. **Helms**. Yes, sir, but you will recall we did not have the most key item in all this discussion until about a year-and-a-half ago, a year ago: test methods and standards. We did not have a way to test this sample or two or three others and end up with a standard until about 1½ or 2 years ago.

I should go further and say for the whole panel of its entire size, we still don't have. That is the reason for that continued test program which will end up next spring.

This will take panels of this material in a full, for example, 4-by-8 sheet size. We will use, I believe there are 27 different sizes that we will use. Depending on the way you burn the material, the way you expose it to heat, you get different results.

I am nearly certain it is 27; it is in that neighborhood, 25 to 27 different sizes of panels and samples. It will take us until next spring to complete it. I am optimistic it is going to work out and therefore we will have the NPRM on materials late next fall, as I say.

Mr. **Molinari**. I am pleased to hear that, but I still have difficulty in my mind trying to understand why it takes so long to develop the test. I am sure there are good reasons for it. I don't know what they are. I would like to know what they are.

Mr. **Helms**. I tried to show that merely for correlation there will be some 425 tests before we even start full-scale testing.

It takes that much testing so that we can quantify to a satisfactory degree what that piece of material will do or won't do.

Then from that, be able to establish a standard we can now turn to the industry and say, these are the specifications; these are the standards to which you must address yourselves.

Once having done that, let's move forward to next year, say this works out. We complete the test and release the NPRM late next fall. That will allow 3 to 6 months for comment which we have to do. That takes us to 1985. We will pull them back together and spend at least 3 to 4 months analyzing them, probably adjusting it and taking a look at it. That is the fall of 1985. We will probably be able to put our final rule in the spring of 1986 if things move along quite well.

By the time we do that and the final rule goes out in the spring of 1986, maybe early summer, we will now have given industry a basis for manufacturing. They will then set up purchase of raw materials, production—by the time you get the basic material, shape it and saw it and put it in place, that is just how long it will take, but I may be wrong.

Mr. MOLINARI. At the time NASA made their press release, you didn't have a test that could take this material and——

Mr. HELMS. That is correct, sir. We did not have.

Mr. MOLINARI. OK.

Turning to page 7 of your statement on the question of the floor proximity emergency lighting you say you recently issued an NPRM on that. Could you describe what system you are talking about there?

We saw a number of different ones at CAMI. Can you describe the one you are talking about here?

Mr. HELMS. Yes, sir. I was not there during your visit, but I am confident what you saw was the full-scale test rig in which you have the lights at a upper height, intermediate level, some with shade or glare levels in candlepower, with different presentation techniques; and one was down about 6 inches from the floor and it was a long, low, flat one and used a type of illumination which required very low voltage.

Part of our problem is, when we put it down there, if we have to run high voltage for it, and the seat comes loose, we have created a potential for a fire.

We found by putting that as close to the floor as possible—and we are looking at the matrix indexing, being able to establish on the floor direction arrows in how to get out moving from one area to another.

When the top of the cabin is full of smoke, and it comes on down we know that the area of greatest visibility is closest to the floor. I suspect that is one of the systems you saw.

That is the one we are identifying.

Mr. MOLINARI. Can you identify the time on the evacuation tests, when they were run by CAMI? Anybody?

Can you, Mr. Broderick?

On page 7 of the testimony the Administrator says, for instance, we recently issued an NPRM for floor proximity emergency lighting. This was based on evacuation tests run at the CAMI Institute.

Mr. HELMS. You refer to "demonstrated a significant decrease in evacuation time"?

Mr. MOLINARI. I am referring to when the tests were done. You say recently—no, you say this is based on evacuations run at CAMI which demonstrated the decrease in evacuation time. When was that?

Mr. HELMS. They were run in the full-scale fuselage at CAMI in which we pumped in various gases and irritants with a full load of people and see——

Mr. MOLINARI. I am not asking for the details concerning how the test was run. I am asking for the period of time when the tests were conducted.

Can you identify that? When the tests you refer to on page 7, when they were run?

Mr. HELMS. They apparently covered a 3-year period starting in 1979 and ending in 1981, Mr. Molinari.

Mr. MOLINARI. I have a recollection that there were some objections that were registered by the folks at CAMI to the system. It looked to us like an attractive idea, but, of course, being laymen, we couldn't make that determination.

I am trying to think about what it was. I think they cited such things as perhaps falling luggage and other items that might have impeded the vision of these.

I am just wondering whether or not what is being announced here as an NPRM is similar to what we saw. That is why I ask about the period when the tests were run. Whether there is something more state-of-the-art than what we saw at that time?

Mr. HELMS. I suspect you saw the final version. At one point in time there was an approach of putting a flared light, one that went out in a cone or spread, a fan-shaped cone, about an inch above or 2 inches above the floor because it specifically lit the floor.

Then the concern was that a fallen coat, hat or something could block it. It was raised up to where it was—I am not exactly sure. I will be glad to get it and furnish it for the record. But somewhere between 6 and 10 inches that appeared to give the highest probability that you would always see it and, second, low enough to accomplish the benefit.

That is possibly the item you refer to, but I don't know more than that, Mr. Molinari.

Mr. MOLINARI. In fairness to the other members of the subcommittee, Mr. Chairman, I think I will pass at this point and I think we have a vote coming up too.

Mr. LEVITAS. That is correct, Mr. Molinari.

Dr. Rowland, why don't you begin and we can resume when we come back? That is the first bell.

Mr. ROWLAND. Thank you very much, Mr. Chairman.

I have a question that I want to ask. Let me commend you on the presentation you made here. It was certainly very enlightening and very helpful to me.

Mr. HELMS. Thank you, sir.

Mr. ROWLAND. I want to briefly refer to something that the chairman brought up and that is the human element which we didn't talk about here only with respect to human tolerance.

I am very concerned about the training that flight crews receive, flight attendants, and also other members of the flight crew in emergency situations.

In emergency situations the response almost has to be a conditioned reflex without time to think because often times there are just minutes or seconds only in which to react.

I would like to have some comments about the training that flight crews get. I have the impression that there is almost a ho-hum attitude on the part of some members of the crew, having observed them on many occasions. I have flown many times in the recent months. I was concerned about the testimony that we received in the Air Canada tragedy situation where we heard that some members of the crew repeatedly reset a circuit breaker that had been tripped.

This concerns me a great deal.

I wish to have you respond about training and about exactly what you think should be done to address this area.

Mr. **Helms**. I think that I would like to start out by folding that question within the broader context.

I started in either June or July of this year to lay out a workshop for next spring in which we would invite the experts from all the areas of the aviation community, flight attendants, pilots, engineers, designers of airplanes, and so forth, to address the question of passenger safety and aviation safety.

The agenda is such that we have now determined that we would have five working groups, one would be an engineering and research working group. This is concerned with cabin materials, egress, the stability of all the elements of the basic machine itself.

The second group would be a human tolerance working group which would include the physiologists, psychologists, people taking a look at what the human tolerance levels should be.

A third group is one which we have spent quite a bit of time on trying to define, what we refer to as passenger education group.

The reason that is key, we don't know how far we can go in passenger education. We have the cabin attendants give a briefing on what will happen if the oxygen mask drops and how they use it. And on overwater flights, how to don life-saving equipment. But we don't know whether we can go further with that in such things as smoke hoods, how you don them and use them. So we want to form a group on passenger education to see how it would work.

Fourth is on the crew training working group which is the thrust of your question.

This covers the full gamut of the crew with exploring not just the latest training methods, but is it possible to use simulation techniques?

The last one is occupant protection equipment, to establish a group to look at medical kits and survival equipment and so on, that entire area. So in that level I have in the final stages a plan that, a work group, or work shop that will probably be in April or May of next year. I would envision a plenary session to have people give papers in different areas and then segregate into the working groups so we now bring expertise addressing each of the issues.

Within that context we have a longer range program. Within the context of the present programs. I think Mr. Broderick should comment on the existing training because I am just not as familiar with the details of the cabin attendants and their training program.

Mr. **Broderick**. OK.

Mr. **Levitas**. At this time I think we ought to break and when we come back, Dr. Rowland, we will begin with you.

The subcommittee will stand in recess for 10 minutes and we will resume. I think my decision will be to go straight through.

Mr. **Helms**. That is fine, I agree with that, sir.

[Recess.]

Mr. LEVITAS. The subcommittee will please come to order.

Dr. Rowland.

Mr. ROWLAND. Thank you, Mr. Chairman.

It is certainly encouraging to know you have programs underway to address the problems of training. Do you suspect that there will be very much resistance from the airlines by attempting to implement more of these features into the overall cabin safety program?

Mr. HELMS. I don't anticipate major opposition to implementing them. Where I think the problem will be is determining the timeframe, the schedule. I think that there will be some action perhaps to encourage me to delay it, but I am not inclined to do that. Once I know we are on sound ground—and I must emphasize we don't do ourselves, the traveling public, the industry any favor to be precipitous—but once we know that, I have no hesitancy to say we will go forward with it.

But I would look for a request for a delay in timing, but not opposition philosophically to the things we want to do.

Mr. ROWLAND. Do you think there will be opposition from members of the crew, flight attendants, or other personnel, to increasing the amount of training they are now having so they may become more proficient?

Mr. HELMS. No, sir. I have not been involved in that element of it as much, but my experience with the cabin crew has been that they readily seek more training and I would not envision that we would have any difficulties there at all.

The problem we may well face there is between the cabin crew and/or the flight deck crew and training them together. This is duty time and, therefore, it is going to—I think it is duty time—it is going to cost the air carrier, then those people's income, their wages, while this training is going on, which could be expensive. So I would look for more opposition from the carrier rather than from the individuals.

I have found the cabin attendants to be desirous of more training.

Mr. ROWLAND. You say this is duty time. Can you give me an idea of how much time flight attendants spend in a typical week on duty?

Mr. HELMS. I would ask Mr. Broderick to do that. I am just not familiar to that extent with it.

Mr. BRODERICK. I would have to get—to get accurate data, I would have to go back to the office and check some records. It varies from airline to airline, of course, depending on the contract arrangements they have.

Mr. HELMS. I might expand that just a little bit. Our regulations refer to flight and duty time. That is duty time that is primarily spent aboard the aircraft. The individual carrier's requirements of the cabin attendants is based on their own labor-management negotiations. That is the reason we are both hesitant to give you a figure which we cannot back up.

Mr. ROWLAND. I am particularly interested in that area. I have read, for example, that pilots spend only a very short time on active duty and get relatively high salaries. I was wondering about the flight attendants, if it is also the situation with them.

Mr. **Helms**. We don't have a specific duty time requirement for cabin attendants like we do with the flight deck crew. But their individual contract invariably has constraints on it and that will vary from carrier to carrier.

Mr. **Rowland**. I am sort of interested to learn more about that as to whether or not they might be willing to secure additional training in order to increase their ability to provide safety if it was not on paid time. I would certainly be interested in that. I know you cannot answer that now.

Mr. **Helms**. I just don't know, I cannot comment on it.

Mr. **Rowland**. One other subject and that is human tolerance. It varies from individual to individual, of course. I would ask you to elaborate on that somewhat, if you would, about what areas are you looking into insofar as determining where best to place people in aircraft—what do you need to know about passengers in order to determine how they can best be dealt with if they are people who might be of low tolerance to any given situation?

Mr. **Helms**. The spectrum is so wide ranging that it is difficult to pick out a particular one. We always talk in terms of G seat loading. As I mentioned, some specimens can take, if properly positioned and they are just set exactly right, we have conducted tests which show that the human being can go up to 22 to 28 g's. The average citizen sitting in a relaxed position, I would doubt could take more than 8 to 8.5 g's. That is a rather wide differential there.

Other aspects of it as how much weight can an individual lift up to put luggage in an overhead luggage compartment, and there you are talking about the juvenile or the older lady or the incapacitated, so we are trying to take a look at the whole aspect of it to see what is the 95th percentile so at least we have something common to address.

That doesn't say we are not interested in the 5 percent, but you must have a criteria to which you design and the 95th percentile seems to be an accepted standard.

We are looking at, of course, the irritant gases. We are looking at even such things as what rate of body moisture loss can be tolerated because of the air conditioning system and dehumidifiers aboard. So we are taking a look at the total spectrum and we are finding that many of these things just had not been looked at before.

There is, to some extent, a shortage of literature which covers the average. We can always find it for that particular group in the case of astronauts, for example. You can pin each one to the individual heart murmur he might have, but we have to design the aircraft for the total of the citizenry. So we are taking a rather wide-ranging group on that.

The other aspect is that in one of the working groups, we don't feel we know enough about the psychology of learning on the part of the casual air traveler, that is, how much information can we present to the average passenger whether he or she is on the airplane for the first time or they routinely fly? How much of that can be retained? How much of it can be used? It is difficult for me to say it is A, B or C, Dr. Rowland.

Mr. **Rowland**. I understand.

You touched on the ambient air, and we have heard testimony that the quality of ambient air in aircraft is very poor. I am glad to hear you are looking into the probability or likelihood of improving that.

Thank you very much, Mr. Chairman. I appreciate the opportunity.

Mr. LEVITAS. Thank you.

Mr. Sundquist.

Mr. SUNDQUIST. Thank you, Mr. Chairman.

I have two questions, Mr. Helms. The first is a very short one. A little following up on my colleague from Georgia. I have observed a cavalier attitude by attendants in regard to explanation of safety requirements on board planes about like Don Meredith reading the disclaimer at the end of the Monday night football game.

I wonder what was being done to perhaps do that in a more serious manner, particularly in terms of the exits and those kinds of things?

Mr. HELMS. Of course each carrier has to submit in their operations manual, a training program, the content of how they will do their operations. We have inspectors that go around from time to time, and we have air carrier inspectors, we have inspectors that sit in on the training programs. I routinely try to do it at least once a month; I'll ride the jump seat by carrier A from point 1 to point 2 and get another carrier back so I can observe the crew, but I suspect we don't catch them all.

Mr. SUNDQUIST. I suspect if you are in the jump seat they will do it right by the book.

Mr. HELMS. Yes, sir; and I find that to be the case.

Mr. SUNDQUIST. I would be curious if you could supply me with information, if you cannot now, of what your inspectors find as they make these unobserved inspections?

Mr. HELMS. We will prepare a report and do it in three geographic areas, perhaps, so it will give you a better idea of the various carriers and effects of it and we will furnish that to you, Mr. Sundquist.

[The information received from Mr. Helms follows:]

BRIEFING MEMORANDUM—OFFICE OF FLIGHT OPERATIONS

SUBJECT: Cabin Safety Information Requested by Mr. Sundquist During Hearing on November 1, 1983.

BACKGROUND: As part of their normal surveillance activities, Federal Aviation Administration (FAA) air carrier inspectors conduct cabin safety evaluation flights. While conducting these flights each inspector is required to complete the air carrier en route cabin inspection report using FAA Form 8430-16 to record the results of the inspection. The en route cabin inspection reports are distributed as follows: The original goes to the certificate holding district office and is reviewed by the principal operations inspector assigned to the operator of the flight. The principal operations inspector takes action as necessary to resolve discrepancies reported in the comment section of these en route reports. A copy is sent to the Office of Flight Operations in Washington, D.C., for systemwide review. On completion of this review the forms are sent to the Protection and Survival Laborataory for entry into the Cabin Safety Data Bank. A copy is also retained in the district office of the inspector that conducted the en route inspection.

The FAA cabin safety data bank is not currently programmed to provide geographic areas information. However, the cabin safety data bank does analyze and collate information from the en route cabin inspection reports on each air carrier and for each type of aircraft being used by the air carrier. The data bank provides an analysis on the following general areas of cabin safety activity and equipment: carry-on baggage; public address system; handicapped; flight attendant maunals; passenger seatbelt discipline; galley; passenger briefing announcements; cabin safety equipment; safety signs/decals and lights; cabin procedures; flight attendants performing non-safety related duties during taxi; flashlights; flight attendants' seat, safety belt, and shoulder harness restraints; passenger information cards; cabin equipment; passenger problems; and general comments.

During 1982 FAA air carrier inspectors completed 2,334 air carrier en route cabin inspection reports. Of this number 871 reports contained comments relating to the general categories described above. As of September 19, the cabin safety data bank has processed 1,427 air carrier en route cabin inspection reports, of which 449 contained comments relating to these general categories. The most recent analysis of the en route reports reveals that the following general categories are most often commented on by the inspectors conducting the inspection: (1) cabin procedures, such as flight attendants putting trash in lavatories prior to landing, flight attendants in cockpit during taxi, or flight attendants disarming evacuation slides prior to reaching the gate; (2) passenger briefing announcements, such as passengers not briefed on use of seat cushions for flotation, announcements given to fast, did not brief on no smoking areas; (3) flight attendant manuals, such as not having required manual or not up-to-date; (4) carry-on baggage, such as excess baggage, oversized baggage, and baggage not properly secured; and (5) passenger seatbelt discipline, such as passengers standing while the seatbelt sign is on, passengers standing during taxi in at destination to retrieve baggage.

In addition to the inspector debriefing of the crew and the actions taken by the principal operations inspector, the Office of Flight Operations periodicaly distributes the results of a nationwide trends analysis of the air carrier cabin en route inspections to all regions. Regions are requested to give special emphasis to apparent adverse trends. Information from the Cabin Safety Data Bank is also used to support rulemaking action when appropriate.

Mr. SUNDQUIST. Thank you very much.

I want to commend you for your presentation. My impression is you are seeking solutions to these problems; is that a fair statement?

Mr. HELMS. Yes, sir, the first thing was to define the methods where we would know and could calibrate our results. Now that we have that we are seeking solutions and in the final stages, on two areas there, I am now attempting to project ahead and do proaction as opposed to reaction to the problems.

Mr. SUNDQUIST. In the pro-action mode, in your letter to the chairman on page 4, there seems to be an inconsistency from your pro-action mode on all those things which I commend you for your leadership in, and where you say—I assume the chairman is going to have comments on this—referring to protective breathing devices:

> We do not find a need to provide protection for passengers beyond the oxygen masks presently provided for rapid decompression and intend to take no action on requiring or developing passenger protective breathing devices.

Then in the last paragraph referring to a witness that we had, this committee had heard from:

> The FAA will review the substantiating data if your witness applies for approval of the protective breathing device, but until he provides the data we can take no further action for approval of the device.

It seems to me that that is a reaction instead of a pro-action, that is from the mindset of FAA where you are seeking rightfully solutions on the whole list and very effectively, but in this case it looks like bureaucratic jibberish if you don't mind me saying so, to discourage something.

I was curious as to your reaction.

Mr. HELMS. In the latter case, Mr. Sundquist, that would be leading towards certification of a device and product development. That is quite a bit different from being able to go back and analyze what the total needs may be of the air passenger.

We are very hesitant to have the FAA certify a particular product of a company. It is sort of like a "Good Housekeeping Seal of Approval." We don't ordinarily do that. We set the standards, they demonstrate the ability of them to meet the standards, and they go on from there.

Mr. SUNDQUIST. Going back to the first paragraph, you say you are not, but in the first paragraph you are. You say, "We don't find the need for protection."

Mr. HELMS. Yes, sir. I mentioned this is the case as of now; the data bank that we have now does not provide data to show that need. We have a lot of testimony from witnesses that say we think there is a need. In response to that, that is why I mentioned earlier that I initiated in July an effort leading toward a major workshop next spring to call together experts and the people who testified here before and let's all get together and decide.

I am certainly not smart enough to make that decision by myself, I will take help from anybody I can get it from. So it was a recognition of what the firm data base is now and we don't see the need.

But in view of the fact so many people say there is, I would like to have a workshop and let us see if there is a need.

Mr. SUNDQUIST. In terms of aluminizing slides, in terms of the interior materials, in terms of antimisting kerosene, did you have a workshop to determine whether there was a need for those?

Mr. HELMS. No, sir; we didn't. Those didn't come from any of the public testimony. They came from our own internal testing. For example in the slides, and part of our fuel fires, fire research, we found that the slides did not stand up under the temperatures which came about as a result of our own testing.

That led us to the conclusion that we may have come up with a way to get people out of the airplane, but it is not a safe way.

Mr. SUNDQUIST. Was there any way of internally determining, based on the response of this committee, that perhaps there may be a need for protective breathing devices instead of holding a workshop? It seems to me that that is another throwaway delaying tactic inadvertently to not address this issue. It seems to me that if enough witnesses have stated it would be of assistance, if the committee thinks it is of assistance, that the only conclusion I can draw is that a workshop, while commendable, is just a way of delaying any action on this.

Mr. HELMS. Of course the workshop has a much, much wider agenda than just that one item, but our problem is if you take the history of the air transportation system and you pick your finite time there is an average of 32 people a year that have lost their lives from aircraft fire.

That is 32 a year.

So it is very difficult when we are talking in terms of some 300 million American passengers and 32 a year lose their lives, of coming up and saying we must now start to come up with a major program. Now we come back against cost-benefit, we come against time, we come against the possibility of a device which we install in every aircraft which addresses that issue but which historical data will show it will fail more times than it can be used because of the low usage rate.

It is 32 people.

Further, if we look at the summary taken by the CAA, my counterpart in England, it shows the percentage of passengers that have been in what is labeled a survivable crash from 1972, and 40 percent of those people survived. That curve has steadily gone up and until 1982 it is now up to around 77 to 78 percent. There has been a steady improvement in the rate of people surviving.

Mr. SUNDQUIST. I have no doubt about that and I compliment you on everything you are doing.

One last point, Mr. Chairman, and that is, Mr. Helms, when you talk about who lost their lives——

Mr. HELMS. Thirty-two per year.

Mr. LEVITAS. Would the gentleman yield?

Mr. SUNDQUIST. I would be happy to yield.

Mr. LEVITAS. Over what period of time?

My statistics are quite different from that.

Mr. HELMS. If we take Tenerife which had the two in collision; and the other in France——

Mr. LEVITAS. What about Pan American Pago-Pago?

Mr. HELMS. I am talking United States.

Mr. LEVITAS. That is a U.S. carrier.

Mr. HELMS. That would have been included, yes, sir. That would be included.

If you take U.S. scheduled air carriers and average it over the years, there has been 32 people a year.

Mr. LEVITAS. Over what period of time?

Mr. HELMS. I think it is from 1965 through 1979.

Mr. BRODERICK. It is about a 15-year period.

Mr. HELMS. I will get the exact data but it appears to be about a 15-year period, Mr. Chairman.

Mr. LEVITAS. I wish you would, because the figures I have, Mr. Helms, I think go back for a 10-year period. Until we had the recent two serious accidents which were crash-related deaths, survivable accidents resulted in the largest single number of commercial aircraft fatalities over a 10-year period. It was something in the range. I don't want to throw out a figure until I look at it, but it was substantially more than what you are talking about.

Mr. HELMS. I just want to be sure we are effectively communicating. My 32 per year are those who have lost their lives due to fires aboard U.S. air carriers operating on normal routes.

That is not the same as the percentage of survivable accidents in which people may have lost their lives. They may have lost their life, but it wasn't due to fire. It may have been other reasons.

Mr. LEVITAS. Or they drown because they couldn't get out of the seat such as in the Air Florida crash.

Mr. HELMS. For whatever reason. We are trying to address the question, if we have fire, fumes, if we have these byproducts of fires, how many people per year are we addressing? We were quite surprised to find it averaged only 32 per year over the last 20-year period.

Mr. SUNDQUIST. My recollection of the cost of this device—how much was the cost, as one witness said, for the device?

Mr. LEVITAS. I think the least complicated one was about $35 and the more expensive one was in the range of $75, as I recall.

Mr. HELMS. Which device is that, Mr. Sundquist?

Mr. SUNDQUIST. It was one that a witness had proposed here.

Mr. HELMS. But I don't know what "this" device is. Are you referring to a personal life system or a hood or something?

Mr. SUNDQUIST. Yes.

Mr. LEVITAS. This was a hood, the hood with the gold material in it and then he had the one——

Mr. HELMS. With the tube that connected up.

Mr. LEVITAS. That was the modification with the tube that recirculates.

Mr. HELMS. We have estimates that go from $80 to as high as $200.

Mr. SUNDQUIST. The answer could be given to this, whatever the deaths, are per year, if you could relate the cost per death as opposed to anything else because we are talking about a relatively inexpensive item. Even though there may be fewer deaths, it may not be that expensive per death as opposed to some other things going on.

Mr. HELMS. Yes, sir.

Mr. SUNDQUIST. Thank you.

[The information received from Mr. Helms follows:]

The agency is currently developing a number of NPRM's that will be addressing interior cabin material fire safety, antimisting fuel, and other occupant safety improvements, as well as re-evaluating previous safety suggestions such as smoke hoods or other passenger protective breathing concepts. A specific cost/benefit statement of smoke hoods versus the cost of a fire fatality cannot be provided at this time. Once the NPRM's that are being developed are completed and an assessment of the system of passenger protection improvements are specified, then a cost/benefit can be made. This effort is scheduled to be completed by the end of 1984

Mr. HELMS. Each time you do that, invariably I get criticized because, let me say, the numbers come out a million, another is $5 million, another $10, another $15 million. I get criticized for saying, "You think a life is only worth a million dollars." I am not saying that. That is just what the numbers show. Or $5 million.

So I am a little touchy of coming up with a finite answer and saying on a cost-benefit analysis a life is worth so much. That is not my judgment.

Mr. SUNDQUIST. I understand; I am talking about a relative commitment of expenditure of funds compared to other expenditures of funds for maximum savings of lives. In other words, prioritizing, which you said earlier is what you are trying to do.

Mr. HELMS. I will look at that and see if we can do a cost-benefit study not just of that, but comparing it with other items and see if we can give you a summary of what the cost per life lost might be.

I don't know whether we can or not but we will certainly try, Mr. Sundquist.

Mr. SUNDQUIST. Obviously that the priority, we have to save the maximum number of lives.

Mr. HELMS. That is what the program is directed toward. Directed toward the maximum number of lives, irrespective of cost, but we will attempt to do that.

Mr. SUNDQUIST. Thank you, Mr. Helms.

Mr. LEVITAS. Thank you, Mr. Sundquist.

Mrs. Johnson.

Mrs. JOHNSON. Mr. Helms, I have just a couple questions and they have to some extent been covered, and I am sorry I was not able to be here for all your testimony or all the questions.

You certainly did provide us with a very substantive presentation and I appreciate it and I am pleased to see you are looking ahead as well as reacting retroactively.

Mr. HELMS. Thank you, Mrs. Johnson.

Mrs. JOHNSON. But it is difficult for myself who lives in a very different world, to understand why a simple and inexpensive item like a smoke detector would not have been required long ago without going through all this complicated system in places like washrooms and kitchens where there is such an obvious possibility of people doing what they are not supposed to be doing in a way they are not supposed to be doing it.

The cost of that is so minimal. It seems to me such an ordinary, commonsense decision that it is distressing to see that a bureaucracy feels compelled to approach it in the same way that they approach materials of which the seats are made and all the complexities of that subject as you described.

And are unable to come up with a regulation until November 19, 1983. I wish you could comment. Don't you have any mechanism whereby you can differentiate between relatively simple decisions and complex decisions so that when something comes on the market that even without evidence of need in a sense, you can respond to sort of a commonsense instinctive reaction that this probably would be good preventive medicine?

Mr. HELMS. I am a little reluctant to have the FAA Administrator—and not just myself, anybody—be in a position to where he applies his commonsense judgment to it. That seems like it may be opening up an area which becomes questionable. But let's back up for a moment.

I don't know anything about the medical profession but I suspect that they approach it on the basis of trying to find ways to prevent items early in the game so they don't have to conduct surgery or something else later.

What does that mean? In the area of cabin safety our first priority is to effect a design that reduces the possibility of fire. We do that through special insulation techniques on wires, we do it through not allowing them to design the airplane so there could be insulation rubbing against metal.

We put spaghettis around it, but fundamentally the best way to not have the fire is to force the design such that it does not occur.

Second, to the extent that there is going to be a fire, then we prefer to contain it, and that that containment or compartment be fire resistible and containable completely unto itself.

As an example, the cargo D compartment, to be able to withstand the highest temperature plus some safety margin that could generate from any material burning in there, must contain that fire and then have it burn out by using up all the oxygen in the compartment. That same requirement exists within the disposal area in lavatories where you have throwaway towels.

The design requirements, Federal air regulations require that when the lid is closed—which is why you always see them with a lid on them, there is never an open one like maybe in a ladies' or men's washroom—there has to be a positive lid on it, that is designed that way on purpose so that if there is a fire in there, once it has consumed the oxygen it will go out.

The second one is compartmentalize it.

The third, then, is to be able to give that person or crew the capability to get rid of the fire, if possible, by an extinguisher, or something like that.

Fourth then becomes the alarm device. So we go philosophically as a result of a half century of development of aviation we first concentrate on trying to prevent the fire; second, containing it; third, giving the people the means to put it out; and fourth, then an alarm system that alerts the crew, because if the other three were successful the fourth one would become an item which is unneeded.

The fact that it has steadily gotten continuously safer for a half century shows it has not been a bad fundamental philosophy. Now I think your question—that is so obvious—I think you could take a look at it anyway. Yes; I agree with you, Mrs. Johnson, but as I noted for the chairman, until I know whether the extinguisher should primarily be in the container where paper towels burn, or whether it should be directed toward the electric motor down underneath, I don't know whether I should write the requirements, so if you, or the designer have wire bundles in back that should be the point of focus.

It is very difficult to write a regulation that considers first the fire container, second the electric motor itself, which is a three-phase electric motor; and third, whether there are wire bundles in back. That just takes a little time to sit down and think out. That is the reason we have taken this long, but we are underway on it. It will be a device to alert you, a smoke detector, if you will. We would kind of like to go a little further.

As I noted, you can take a particular sample of material, and depending on how you burn it you will get different results, so we would like to see if it is possible to have either smoke or other chemical evidences of flame or combustion underway. Can we do that? There are some indications that maybe we can. So if we can do that and combine that with a built-in extinguisher, we are getting somewhere. That takes a little time. I know we use a lot more words, but that is the way we have approached aircraft design for, say, a half century.

Mrs. Johnson. I appreciate your thorough explanation and I certainly do agree with you overall in the philosophy of addressing fire prevention in terms of design and all of those other things much earlier in the construction of the aircraft.

It does seem to me that the regulatory process does need a way to respond to rather simple aspects and things that may not be—it is true after much thought you may decide it should be on the left instead of the right wall or 2 feet down instead of 3 feet up. But I am struck by the rigidity of the regulatory process, and believe that you really ought to have some way of dealing with rather simplistic things, and then coming back to them later on, especially if they are low cost.

Mr. HELMS. I would agree with you and we would certainly seek the support of the Congress being able to change it. Under the Administrative Procedures Act and otherwise, I have no legal authority to go any other way other than by notice of proposed rulemaking.

Mrs. JOHNSON. Let me also direct your attention to one other thing that I have very great concern about, and that is the training of flight attendants. I know that this subject has been broached by others, but I would absolutely urge you again as sort of part of the simplistic general public out there. I have a fire extinguisher in my kitchen and I have often thought if I really have to use it, does it have a kick like a rifle?

I know that is a stupid question, but if you don't know that before you pull that, you know you are dealing with something pressurized unless you have actually stood there and put a fire out, I tell you when a lot of people's lives are on your shoulders, you ought to have pulled that pin. You ought to have used that fire extinguisher and you ought to have actually seen those flames go out as a result of your personal action.

And I think there is absolutely no substitute, no kind of training is worth anything relative to actually putting it out, I don't care what the expense is. And I would certainly urge you to reevaluate your training, the regulations that govern training, and to assure that this ought to be one of those things that ought to be addressable with some other system other than 2 years of consideration and publishing of X, Y, and Z, because as far as I am concerned we are really failing the public unless every one of those men and women on that airplane has actually put a fire out.

Mr. HELMS. As we indicated, we have started to address that in a more positive fashion. It is not just holding the equipment anymore. We have just about completed the specifications for a training device, in which they will have that opportunity to actually put out a fire. So we do not take exception at all, Mrs. Johnson, to your observation.

Mrs. JOHNSON. One last question. You have two NPRM's recently published, comment period, cutoff date, and so on, and so forth, and you have that about some other things that you are doing. How long will it be between the time that that regulation is final and we can expect that all aircraft will have complied? Does it vary from standard, from regulation to regulation, and can you give us some indication as to the variation in timeframe from simplistic things like smoke detectors versus seat replacement?

Mr. HELMS. Yes, it does vary for each individual item. The most simple one I would suspect—and I am dealing off the top of my head without examining—we would be fortunate to see it in scheduled regular service in less than 2½ years, and it could go as long as 5 years by the time the aircraft go through their normal maintenance check, review, and installation under a mandatory requirement. It will take——

Mrs. **Johnson**. Do you necessarily require, allow them to use up the equipment that they have in terms of its useful life, before they are required to replace with a safer equipment?

Mr. **Helms**. No. It varies. For example, we may require that they make that change at what we call a D check, which is their next major inspection check. Whether the existing fire extinguishers have used their life or not, at that point in time they would have to change them to the Halon 1211. We are specifying there must be at least two aboard. We specify at that D check the smoke detector and extinguisher will be installed.

No, we don't necessarily let them use up the entire life, but we have to be a little careful, because if we put this out and say effective such-and-such a date, and there are not sources of supply, there are not shops that can install, we may have the entire Nation's air-fleet grounded.

What we try to do is to work out a schedule to where each one of them can get maybe 25 percent of their airplanes in per quarter. Now, they have got a year to do it, to get it in, depending on what that D check period is. We try to work with them but we don't back off from requiring that it be installed.

Mrs. **Johnson**. Thank you, Mr. Chairman.

Mr. **Levitas**. Thank you, Mrs. Johnson. I appreciate those questions.

Let me say, Mr. Broderick, before I get into my specific questions, that I am really disappointed to learn that you had not read the testimony of the flight attendants who testified at our last hearing. You know, I sit at these hearings from time to time when the top FAA management is not here and I look out in the room and I am able to identify some relatively well-paid people from your legislative liaison office. They are sitting out there presumably to take notes and report back to the people who aren't here about what is going on, and I know they on some occasions do that.

I guess, second only to the downtown lawyers who get paid $120 an hour for doing the same thing, those people, if they have a function, aren't performing it if you don't find out what happens here. I can tell you—and I think the other members who sat in on those hearings will agree with me—that there was some extremely important testimony.

You are in charge of flight operations, is that right, or standards?

Mr. **Broderick**. Aviation standards.

Mr. **Levitas**. Aviation standards, and you are the person who ought to be knowing that. As I was sitting here thinking about it, I said, what is accomplished by having witnesses come in, present evidence and testimony, and then the people who ought to be hearing it don't find out about it?

Mr. **Broderick**. At the recess, sir, I did make contact with the committee counsel and arranged to get copies of that material, that testimony, which has not to my knowledge been transmitted to the FAA, because we were not participants in those hearings. I don't believe it is yet published by the committee.

Mr. **Levitas**. I am sure it is not. Find out what GS-13 was over here sitting through those hearings and what he or she didn't bring back to you. Mr. Helms, don't they come over here to find out what is going on and report back to you people?

Mr. BRODERICK. Mr. Chairman, if I might, I have read notes of the legislative liaison who were here. Your question, sir, was had I read the transcript of the 3 days of testimony, and, no, I haven't.

Mr. LEVITAS. You appear to me to be unaware of what they had said here, and that is why I asked you if you had read the transcript. What they said here about their lack of training, recurrent training, their lack of adequate training with respect to new aircraft that come on line, and their lack of hands-on activity of the sort that Mrs. Johnson has just described was very significant testimony. I am simply saying there needs to be a way for you to find out about it.

I was critical early this week of Mr. Helms. I will get back to that later, too. Because I don't think that everything that goes on, even the important things, necessarily get up to you people, and this just struck me as an example of that type of situation.

Mr. HELMS. We try to have someone over, Mr. Chairman, but I had congressional hearings last Wednesday, last Friday. I had two the same day at 10 o'clock, so one of them had to be taken by another one. I have another one tomorrow morning. In the period from I believe—and I wouldn't want these dates to be firm—between October 20 and December 6, I had 14 congressional hearings.

Mr. LEVITAS. There is a great deal of interest in what you are doing.

Mr. HELMS. I accept my responsibility to keep the Congress informed.

Mr. LEVITAS. Let me get into the substance of the remaining questions I want to ask. In the letter, as Mr. Sundquist I believe brought out, you said in responding to Mr. Molinari and myself:

> We do not find a need to provide protection for passengers beyond the oxygen masks presently provided for rapid decompression, and intend to take no action on requiring or developing passenger protective breathing devices.

Now I will tell you that, as you have indicated, there is a rather substantial body of opinion to the contrary. There is direct testimony that the 22 or 23 people who perished in the Air Canada disaster perished from inhaling toxic fumes, and I think it is pretty clear that if they had had a protective breathing device or some other means of not inhaling those fumes, they would be alive today.

But let's listen to what FAA said. I know you are familiar with it. FAA notice 69-2 is proposing that part 121 of the Federal Aviation Regulations be amended to require smoke hoods, as developed by, et cetera, be installed at each seat position in airline aircraft for use during emergency evacuation, and FAA concluded that "prototype smoke hoods have been tested and evaluated to an extent sufficient to justify a requirement at the present time."

Now, I assume 69–2 means that was issued in 1969. It is my understanding that subsequently that notice was withdrawn, and it was withdrawn with an accompanying statement that, "We still think it is a good idea, but we need to do some more testing on it." Now, leaving aside whether there is the device available—and we have had plenty of testimony on that. In 1976 we had hearings, and

I remember the now-majority leader putting one of those hoods on and the blowtorch up against his face, and we had hearings this year showing the same thing. But you now are not only saying there is not a system available, which is questionable, but you say, "We don't find the need."

Now, what happened between 1969 and 1983 that the need disappeared?

Mr. **Helms**. Well, the most significant item that occurred was flashover. I have no information from any proposal by any manufacturer that if you set a person down who has never put one of these on, that he can get it on and have it functional in 15 seconds. Most of them run anywhere from 30 seconds to a minute and a half.

Mr. Chairman, our Federal air regulations require that the entire airplane be evacuated in 90 seconds, even if it is a 747, so to the extent that we now say do this instead of getting out of that airplane, it has a negative effect.

I have said research is only successful when it solves the problem and does not create a worse secondary problem.

In an effort to further examine it, we examined the possibility of curtains, and we found that, yes, can you compartmentalize it? Yes, you can, but it must be a curtain which has, in essence, an air seal. Now, you have established a barrier that prevents the people from the most fundamental thing we can do, which is get them out of that airplane, so now the tradeoff is do we put these in, recognizing that pilferage and other items will be such that we will now have to go through if you had a regulation—you cannot take off until you have one for every seat.

Now, between every flight the cabin attendants, instead of perhaps looking at other safety devices, will now have to go along and count these to make sure there is one for every seat. I am not sure how many will have to be replaced. We are talking about millions of dollars a year.

Mr. **Levitas**. Mr. Helms, my question was, in 1969 FAA said there was a need, not whether it was going to work or not. They did not say it was going to work then, but they said there was a need. We have had people perish from inhaling toxic fumes and smoke, and asphyxiating, others who survived the accident. When did the need disappear? What documentation is there that there is no need when FAA is on record that there is a need?

Mr. **Helms**. I am not aware that there is any documentation of record that says there is not a need. My concern is in a way it follows Mrs. Johnson's observation. We could have gone ahead and said, yes, we will satisfy the need, and lost more lives because of the time lost with people evacuating the airplane. Now we have fulfilled our need but we have cost more people their lives. I was very much impressed by the late 1981, early 1982 discoveries that the flashover phenomenon is what takes most lives. By far more than any other item than fires. Getting those people out is the key item.

Mr. **Levitas**. Let me just refer you back to your letter. When you get a chance, contemplate what I have just said to you.

Mr. **Helms**. Yes, sir.

Mr. LEVITAS. FAA said there was a need in 1969. People have died from asphyxiation and toxic fumes since then. Your letter to Mr. Molinari and me in 1983 said, "We do not find a need." Is anybody at the table familiar with the January 1979 FAA Civil Aeromedical Institute document "Air Crew and Passenger Protective Breathing Studies"?

Mr. BRODERICK. I believe, sir, that is the foundation document for the CAMI standards which then were adopted into national standards in a TSO for the protective breathing equipment.

Mr. LEVITAS. It is. Air crew and protective breathing is the title of this. My question is, on page 42 of this document, there is a description of a relatively simple device which could provide some protection from inflight smoke and toxic fumes, which makes use of the existing oxygen mask with a related system, not the oxygen, obviously, but a related system.

Now, would there be any great problem in requiring this simple device to be installed without aircraft passenger oxygen masks being replaced? If you are not prepared to respond to that this time, then I would like you to submit your response in writing.

Mr. HELMS. I have seen a little bit of information. I think it refers to a concept where you have the panel overhead that the oxygen masks drop out of. You install a separate device as part of the fresh-air system, and in the event of toxic fumes or smoke or something of that order, either actuation by the air crew or maybe the cabin crew drops these and they are then put on and the people breathe this out of the fresh-air system. I believe that is the system you are referring to.

Mr. LEVITAS. I think that is correct.

Mr. HELMS. Yes, sir; we will take a look at it, and give you a summary paper on it and what appears to be the impact of it, and get back to you, Mr. Chairman.

[The following was received from Mr. Helms:]

As the committee is aware, various reports addressing protective breathing devices for the aircraft passenger have been proposed and considered by the FAA since 1967. The most recent review of some of the more promising concepts is summarized in FAA-AM83-10 written by the Civil Aeromedical Institute. However, there is no current summary paper that would answer your specific question. A team is currently reevaluating the question of passenger protective breathing concepts in an objective manner to arrive at an agency recommendation of whether or not such a device could be helpful. How would it fit into the overall cabin safety changes currently being considered, at what cost, and how might it be implemented? The task is scheduled for completion by mid-year and will be provided the committee to resolve the question in a factual manner.

Mr. LEVITAS. One other thing, Mr. Helms. Your letter to Mr. Molinari and myself says there is no need. I am informed from several sources that FAA aircraft have on board protective breathing devices for passengers other than the crew.

Mr. HELMS. If that is the case, I know nothing about it.

Mr. BRODERICK. Let me explain that, sir. That is not true now. At a time back following that 1969 publication that you are talking about, it is my understanding—I wasn't here then either—that we got a series of free samples, and people put them in their airplanes.

It was not a question of buying anything or equipping the FAA fleet; it was merely, effectively, a disposition of free samples, and there are none in any of the aircraft that are in this area that I know of. There may be some in some of the flight inspection aircraft.

Mr. **Levitas**. I have verified as recently as this morning the fact that there are such protective breathing devices in some FAA aircraft. I am also informed that in some of the towers, personnel carry their own, provide their own smoke hoods and protective breathing devices.

Mr. **Helms**. In the last case, Mr. Chairman, we specify that, and it depends on the entire design. The reason is that you cannot have an elevator that goes all the way up and you cannot be sure that the elevator is going to go. We have a very strong concern about the safety of those people up on top of this pillar. Therefore we require that there be protective breathing devices for our crew that is in the tower cab so that they can work their way down and not be trapped up there.

I would ask if the chairman could help us a little bit by giving us a hint or some guidance as to even which region he was aware that there were some protective breathing devices.

Mr. **Levitas**. We will furnish you.

Mr. **Helms**. I would like to follow up. I am not aware and I have never seen a protective——

Mr. **Levitas**. There is nothing wrong with it. It is not like contraband or something like that.

Mr. **Helms**. No, sir, but I am concerned why they would have it and we do not have it, for the pilot and copilot.

Mr. **Levitas**. I think you perceive my point.

Mr. **Helms**. Yes, sir.

Mr. **Levitas**. It seems to me that I have been listening to testimony on this subject now for the 9 years I have been on this subcommittee. I remember when the majority leader was chairman of this subcommittee, and held some hearings on this same subject, as I alluded to earlier, with the same questions and the same answers. The only thing is that the need for protective breathing devices has disappeared sometime between then and now, and I just find that odd, since it appears to be such a simple technology, and one that provides between, as I recall, the 6 and 8 minutes of air for a passenger to breathe, and even if you are using the 90-second evacuation time, remember the people on Air Canada never got a chance to have those 90 seconds. There obviously was a need there. So I have to agree with Mr. Sundquist. I think that there is a real feeling, not just by the members of this committee, who have listened to testimony for years now, but by flight attendants, by airline passenger representatives, by others, that leads me to believe FAA, Mr. Helms, needs to step back and take another look at its position on this one.

Let me ask you one last question. You were talking about protective breathing devices for flight crews, and hopefully that includes both the cockpit and——

Mr. **Helms**. Cabin attendants.

Mr. **Levitas**. Cabin attendants. Did anyone call to your attention just one idea that was being put forth by some witness at our last hearing, about this inflatable, I guess, balloon, for lack of a better word, that would be transparent, plastic, and would fit up against the instrument panel?

Mr. **Helms**. Yes, sir. I read that in the transcripts where I saw it. We had three problems with the device—three things that cause me some concern. One is the protection of that balloon material in a satisfactory container so that when he or she needs it, it is going to work.

The second one had to do with the various aircraft as such, that it is very difficult for the pilot to get close to the windshield. There is an instrument hood on the panel and sometimes it comes down at an angle and it is possible this would have to be a variant to the individual aircraft, but the one that really caused me the concern was that assuming he or she got the balloon blown up and had their face against it and was looking out, there is no way for them to breathe, because the very thing that closes them off——

Mr. **Levitas**. It is to be used in conjunction with a protective breathing device.

Mr. **Helms**. I did not get that impression. I thought that the balloon was directly against the face

Mr. **Levitas**. No; this was just for the visibility question.

Mr. **Helms**. We require, of course, goggles for the air carrier, vented goggles for the air carrier.

Mr. **Levitas**. If you will recall, in Air Canada the cockpit was so filled with black and dense smoke they could not see the instrument panel.

Mr. **Helms**. Yes.

Mr. **Levitas**. This created a smoke-free environment between the two parts of the plastic material, and the protective breathing device would be used in conjunction with that.

Mr. **Helms**. We have an airworthiness directive in the final stages by northwest mountain region specifically on the area of goggles to make sure that they are compatible, for that very reason, Mr. Chairman.

Mr. **Levitas**. Again this is another example. I guess what I am saying is, there is no sense in us being contentious about this at this point. But I get the feeling that there is sort of a resistance to innovation from the outside, a sort of reluctance within FAA to really take a hard look at some new innovative ideas that are not generated within FAA, and this was just one example. The protective breathing equipment is another. I could identify a few others. But here is a situation where there is a relatively simple technology, and it may not work, but I think it is entitled to an opportunity, particularly in light of the experience of Air Canada.

Mr. **Helms**. It is worth looking at, but since I have been Administrator, I went to the outside to a group on stall-spin accidents specifically to have them tell us what we should be doing; I went to them to tell us what we should do on our syllabus, to an outside group to tell us what should be done to improve aviation safety, the entire spectrum which is having very good results. I went to a panel to tell us how we should improve airport capacity. I have repeatedly gone outside the FAA so that we would not be burdened by or a prisoner of the historical precepts which had been laid down over the years.

I, personally, welcome information and help from anyone I can get it. In the area of aviation safety, my door is open anytime. There is just nothing that I will spend as much time on as being able to treat the possibility of improving aviation safety, so I would hope we do not have the view that unless it is inside it is not good, Mr. Chairman.

Mr. **Levitas**. I think you understand the concern.

Mr. **Helms**. Yes, sir.

Mr. **Levitas**. One last comment about the hood. Again, just from various sources, and we will be glad to share it with you, because from my point of view, I think it makes a lot of sense to have one of these things. I am very seriously contemplating carrying one in my briefcase, and keeping them at my home as well, because of the problems associated with fire and smoke. I just think that this is an area that really requires people who are in a position to do something about it to focus on it. I know for a fact that a number of airline personnel, and I am told some FAA personnel routinely carry these with them. It may be that the answer is these people are professionals who know how to use it, and therefore you do not have the problem that you would with the general public. But in 1969 FAA thought there was a need, and in 1983 they do not.

Mr. **Helms**. In that area of the letter I will go back and review again, Mr. Chairman and Mr. Molinari. Second, I will very firmly insure that that is a part of the study by all the experts, and of course this will include cabin crews and everybody else that wants to comment on it at the workshop in the spring to see if we cannot define all the pros and cons to know where we stand. That would primarily be an outside group again, so that we are not dependent upon the precepts that have been developed within FAA.

Mr. **Levitas**. My last question is this: On cabin safety matters of the sort that you described today, how many, and you can provide this for the record, how many unresolved recommendations are there from NTSB?

Second, how many of the recommendations which have been resolved resulted in a rejection by FAA of the proposed recommendation?

Third, how many of those recommendations have been made on more than one occasion?

Mr. **Helms**. I will go back and research the record. From my memory, and I would like the opportunity to correct it for the record, there have been 1,680 recommendations made to the FAA by the end of September. All but 393 of those were accepted by the FAA. Of the 393, 200 I believe were open acceptable, which means we are working on them in some way, and 17 had been rejected, but I would like the opportunity to go back and verify.

Mr. **Levitas**. I would like to do that. I am specifically concerned for this record about those related to cabin safety, materials, fire, explosion, smoke, toxicity, the type of matters you were testifying about today.

Mr. **Helms**. We will furnish you a total summary and then break it down by those characteristics.

Mr. **Levitas**. We will make that part of the record. I think it is important that we do so along with the other information that you indicated you would be supplying to us.

[The information received from Mr. Helms follows:]

Twenty-two NTSB recommendations addressing cabin safety issues are closed and 15 are classified as open acceptable. Recommendations addressing smoke hood, cabin interior materials, cabin windows, etc., are all part of the overall aircraft fire safety programs presented during the hearing and will result in action that the FAA considers responsive where a realistic safety improvement can be expected. The NTSB has submitted 1717 recommendations, in total, as of September 1983. All but 345 were accepted by the FAA. The FAA is currently working these 345 recommendations. Of these, 217 are acceptable and considered open until action is completed, 6 are open unacceptable, 15 have been rejected FAA considers 87 action completed, and the remaining 20 actions are not yet due to the Board. The specific numbers almost vary daily, but the clear fact is that the agency responds in a positive manner to the majority of the recommendations.

Mr. LEVITAS. Mr. Molinari.

Mr. MOLINARI. Mr. Helms, looking at the boards that are visible to us now, we see the number of tests that have been conducted in the various categories, and indeed the numbers are somewhat impressive. I look at the seat-blocking layer, which is more than halfway down, and I read that there were 219 tests conducted so far.

Then in the right-hand section we see that the NPRM was issued on September 19, 1983.

Since the Air Canada crash occurred on June 2, 1983, I find it difficult to believe that that accident had nothing to do with the adoption of the regulatory change proposed on September 19, and I think that is what you said during your testimony.

Mr. HELMS. That is correct. It came to me in February of this year. I reviewed the data, and there were a few more tests that I wanted conducted, to make absolutely certain. Those were conducted in April, May, and June. I got the final report in June. Once I was satisfied, we signed it out in July.

Mr. MOLINARI. In no way was there any relationship between the incident, the crash of Air Canada, which would have caused expediting of the adoption of that proposal?

Mr. HELMS. No, sir. The record was too far along at that point in time. There would be no way we could have conducted those tests. As a matter of fact, all the tests had been conducted prior to that time.

Mr. MOLINARI. I am not suggesting the conducting of the test. It just seems to me so much of a coincidence when we see the boards there, and then we realize that July, August, September, a little over 3 months or 4 months, we have an adoption of a plan now that seemed to have a direct relationship to an incident that shocked the entire country, certainly members of this subcommittee.

Mr. HELMS. That is possible, Mr. Molinari.

Mr. MOLINARI. And you say today it was a sheer coincidence.

Mr. HELMS. Yes, sir. At the same time, I am not aware, anyway, of any indication that the cabin emergency lights were a function in one way or another of the Cincinnati incident. I do not know whether they were or not, but that came out.

Let us go a step further. If you look at that schedule, we see cargo compartments scheduled in late 1983. Now, if something happened somewhere between now and November-December 1983, one could say did you not do that because of the accident? The distinction I am establishing is that the schedule was there. We were a little later than I had planned. I had hoped to have it out in May, but when I saw the last test data I just had to see a little bit more done first.

Mr. MOLINARI. What you are saying, you would have a schedule back in your office someplace indicating that it was programmed before the Air Canada crash, to implement these regulations at the time you did?

Mr. HELMS. I think it was originally scheduled in May and we did not make it until July, because when I looked at the data in February, I was not 100 percent satisfied, so I had to delay it another 2 months until I could be absolutely certain.

Mr. MOLINARI. What I am trying to establish here, not just specifically that incident, the Air Canada crash, but other incidents which cause you to expedite a process or a regulation that you are considering, because of a crash where lives have been lost where there might have been survivability. Is there any relationship between the incidents and the work you are doing, the tests you are performing, the regulations you adopt? Do you react? Is there reaction by FAA to incidents that occur from time to time?

Mr. HELMS. We certainly react to incidents, I do not think there is any question about that, and the most rapid reaction we can get are AD's. That is a very common occurrence where we will get an airworthiness directive out as a result of an accident. But in the area of NPRM's and the other, those are all pretty well items that were laid out in the master programs here.

Mr. MOLINARI. Could you suspend for a moment, please?

Mr. HELMS. Yes, sir.

Mr. LEVITAS. Mr. Helms, while Mr. Molinari is checking over there, let me get back to my point on the protective breathing devices. If you will have somebody review the 1976 hearings, the report 94-44—Mr. Molinari is going to have to leave, and has requested permission to submit the remaining questions in writing.

Mr. HELMS. I was going to suggest if you will, we will supply it for the record, Mr. Molinari.

Mr. MOLINARI. I thank you for your cooperation.

Mr. HELMS. Thank you, sir.

Mr. LEVITAS. In any event, if you will look back at those hearings, and have somebody check it, you will find that FAA withdrew the notice that I referred to earlier, in August 1970. But at those hearings it was brought out that an Associate Administrator had indicated in a memorandum that even though the notice was being withdrawn, the Agency should continue diligently to pursue the potential of smoke hoods. No efforts were made after that until 1976 when these hearings occurred, and the FAA Flight Surgeon stated in those hearings, in 1976, that he supported a reexamination of the smoke hood issue, because FAA's research into other methods of fire, smoke, toxic fume protection, had failed to produce improvements. He made the same statement in September 1979 hearings: "We could find no documented rationale for FAA's failure to explore the possibility further."

There is a pretty good history here that I think you need to reevaluate.

Mr. HELMS. I will do so. It is evident that I have not been up-to-date on that one segment. I have spent more time laying out a master program. I will have to get into it and get on it myself, Mr. Chairman.

Mr. Levitas. Incidentally, the figures, and again you may get some better figures than these, from 1970 to 1978 indicate there were 16 survivable accidents involving postcrash fires involving 419 fatalities. That does not include the Tenerife tragedy, because 157 of the fatalities could not be determined positively as the related cause. The total number of accidents with fire involvement from 1969 to 1978 resulted in 1,917 fatalities, which represented 27 percent of the whatever SOB stands for.

Mr. Helms. Souls on board, sir.

Mr. Levitas. I just mention that, and you may have, I am sure you do have some more updated information. I have no further questions.

Mr. Sundquist, do you have any further questions?

If not, if there are no further questions, Mr. Helms, Mr. Broderick, Mr. Blake, we appreciate your participation here today. I think this places another dimension in our continuing investigation into aviation safety and particularly the question of cabin safety. As I indicated in my earlier statement, the subject matter is one which we are going to continue to have hearings on. In fact, tomorrow we will be resuming hearings on this subject. The water survivable techniques which you made reference to earlier will be one of the focal points of that particular hearing, and hopefully one of your efficient legislative liaison people might even take the time to report back on what happens at that hearing tomorrow.

Mr. Helms. I am sure we will.

Mr. Levitas. We will ask you about it next time.

Mr. Helms. We thank you for the opportunity to respond, Mr. Chairman, and welcome the committee's investigation or inquiry at any time.

Mr. Levitas. I have just been handed a document, a copy of a page from an article in the University of Michigan Transportation Research Institute Research Review. This would be 1983. This would be the winter of 1983, and in it it says, and I am quoting:

> After extensive testing the FAA proposed smoke hoods to the commercial airlines some 15 years ago, but smoke hoods can be found now only on some Government and corporate planes.

That is just one example of the sort of information we have received, but we have some specific other information.

Mr. Helms. All right, sir.

Mr. Levitas. I want to thank you, Mr. Helms, for your being here. I guess it is the second time this week, no, it was last Friday that you were with us. It seems like this week.

Mr. Helms. And the Wednesday before.

Mr. Levitas. And I appreciate it. I might tell you that the feedback we have had from controllers out in the field was very much along the lines of those four young men who testified—you need to know that—from other centers that have called in to us and say, "We have got the same type of situation they did in Leesburg. We have the same situation as they did at Los Angeles."

Mr. Helms. How did they hear about that, Mr. Chairman?

Mr. Levitas. I do not know. I found out, as a matter of fact, that even before we had the hearing, people out in the Los Angeles center and Leesburg were talking, asking these individuals who were coming to testify.

Mr. **Helms**. I am continually struck by the dichotomy that we do not have an effective communications system to get a thought or philosophy down, but we have got the doggondest communication I have ever seen.

Mr. **Levitas**. You ought to hook up with the controller system. That may have been the problem. You are using yours and they are using theirs.

Mr. **Sundquist**. Mr. Chairman, there was a report in the newspaper.

Mr. **Helms**. Yes, sir, but that was my concern, that it covered the first part of the hearings, and it is my understanding that there was no coverage of the second part, in which our controllers that we brought with us that volunteered, and therefore there may have been a little biased reporting, but——

Mr. **Levitas**. The UPI story that I saw, and I did not see how it got published, did contain both aspects of it.

Mr. **Helms**. We are going to follow up in any event on that.

Mr. **Levitas**. The only concern I have, and I am not sitting as judge or jury in this matter. But I am concerned that the problem is, as I see it personally in what I am getting in terms of feedback, it is not resolving the problem for you to believe that it is not out there, whether it is at Cleveland or St. Louis or wherever else it might be. I know the places I have been and the reports I have heard would indicate the problem is there, and as I told you last week, again, it took a lot of courage for those four people to come in and say what they said. They were sitting right in front of their boss, and they were saying things not that were anti-FAA or anti-Helms. They were saying, "We care about what we are doing, and so much so that we are willing to take the heat to come forward."

Mr. **Helms**. I took steps during the hearing——

Mr. **Levitas**. I do not contradict what those other two gentlemen said who were sitting with you. It is a hell of a lot easier to come and sit next to your boss and say he is doing a good job than to sit in front of him and say, "We have got some problems."

Mr. **Helms**. I took steps during the hearing to personally assure them that nothing was going to happen to them for their action, because I am not going to allow that to happen, but at the same time I cannot take it out of my mind the two controllers did not have to be subpoenaed, came forward on their own voluntarily, and others offered to, and sat here and one of them said as near as I can recall, "It just seems to me that man is not working at the same facility I am."

Do you recall that in reference to——

Mr. **Levitas**. Yes, I remember that very well. The reason those people were subpoenaed, obviously, was, according to my information, to make it possible for them to have their expenses paid. I do not know, do you know who paid the expenses of the other two controllers?

Mr. **Helms**. I am under the impression they paid their own. We did not. I am under the impression we did not.

Mr. **Levitas**. You might check on that.

Mr. **Helms**. All right, sir.

Mr. **Levitas**. Again, I do not want to make a judgment. You check on that.

Mr. **Helms**. I understand.

Mr. **Levitas**. My understanding is they did not pay their own, but I would like to know since you brought it up. Anyway, the evil of that day is such unto itself. I do not think we need to get back into it. We will on another occasion. Anyway, I appreciate your being here. Also the attendance of your colleagues. We will be following this and working with you, because there is no doubt in my mind that we have a common purpose, which is to make aviation in this country as safe as it can be.

[Subsequently the subcommittee determined through FAA records that FAA paid all expenses of the two controllers.]

Mr. **Helms**. Yes, sir.

Mr. **Levitas**. There being no further business, the subcommittee will stand adjourned until 10 a.m. tomorrow morning.

Mr. **Helms**. Thank you, Mr. Chairman.

[Whereupon, at 1:35 p.m., the subcommittee was recessed, to reconvene at 10 a.m., Wednesday, November 2, 1983.]

[Subsequent to the hearing, the following was received from Xenex Corp.:]

XENEX CORPORATION

28 November 1983

REC'D DEC 3 1983
Subcommittee on Investigations
and Oversight
Committee on Public Works
and Transportation

Mr. John P. O'Hara
Staff Director and Counsel
Subcommittee on Investigations
and Oversight
B-376 Rayburn House Office Bldg.
Washington D.C. 20515

RE: Your communication 10/7/83 - Our comments in response to FAA statements made to your Committee.

Dear Jack:

Thank you for the above referenced communication.

I read the response from the FAA and will provide the following comments. The first paragraph after question No. 4, which starts "The FAA has not ignored..." contains statements made by the FAA which obviously do not reconcile themselves with their posture in the second paragraph (which continued from Page 3 to Page 4) wherein they say "We do not find a need to provide protection for passengers...". There is no question in my mind that they have spent millions of dollars researching over the past 20 years viable methods for providing toxic fume protection for passengers. As a matter of fact, the FAA is on record and has proposed rulemaking in the area in the late 1960s. Their sudden change of heart is difficult, if not impossible, to comprehend.

Concerning the second paragraph after question No. 4 which starts "On the general issue of protective breathing equipment..." I have the following comments. First of all, I agree with the FAA that there are numerous devices on the market which "claim to provide protection from smoke and toxic gases", but in fact are plagued with serious technical deficiencies. The Xenex PELS, however, is not one of them. It provides an unlimited quantity of fresh breathable air. The Xenex PELS uses the existing FAA approved systems on board aircraft.

The FAA is questioning whether or not it is their duty to regulate and mandate that protection be provided to cabin crew and passengers against being asphyxiated. I believe the

1400 KAPIOLANI BOULEVARD, SUITE C-4, HONOLULU, HAWAII 96814 U.S.A.
PHONE: (808) 941-1177 · CABLE: XENEX · HONOLULU ITT TELEX: 7430496 (XENEX)

Federal Aviation Act is very clear on the matter. The FAA is to promote safety. They have recognized the need to protect the pilots (15 minutes of toxic fume protection according to the existing old outdated regulations). The need for respiratory protection against lethal smoke and toxic fumes is no less for the cabin crew and the passengers than it is for the pilots.

As to the FAA's current and proposed actions "...in many areas that will improve survivability in the cabin..." the "(1) issuance of an NPRM on seat cushion fire blocking layers" is only two decades overdue. Likewise with "(2) issuance of an NPRM on low level emergency lighting". CAMI did this work many years ago yet the FAA sits back and waits to act until a disaster occurs.

The "(3) issuance of an NPRM on installation of smoke detection systems and other fire protection measures in lavatories and galleys" is also two decades overdue.

The "(4) issuance of TSO-C99 establishing requirements for protective breathing equipment" is only applicable to crew members and again this should have been taken care of two decades ago.

The "(5) issuance of an NPRM requiring protective breathing equipment meeting TSO-C99 on Part 121 air carrier aircraft, and future changes to make Part 25 protective breathing equipment requirements consistent with TSO-C99" is clearly an appendage to No. (4) and goes without saying.

The "(6) issuance of TSO-C69a requiring, after December 3, 1984, newly manufactured airplane slides to have improved fire protection" is self explanatory. Again, when they first designed those slides they should have obviously done their homework and required that they be made out of some fire protective material.

As it concerns "(7) establishment of rulemaking project to specify improved fire protection criteria in Part 25 for cargo compartments, as a result of recently completed research at the Technical Center" whatever changes they are proposing really won't be visible for another 10 or 20 years since they are proposing it under Part 25.

"(8) research on methods to improve the flame hardening and reduce smoke and toxic gas emissions from cabin sidewall and overhead panels" FAA has been working on this for years, as have numerous companies in industry. It would be reasonable to assume that FAA and industry have an ongoing research effort in this area.

"(9) research on methods for evacuation of smoke from cabins should a fire occur". This work has been going on in industry for, I am sure, more than 40 years yet to date there are no regulations for smoke evacuation from the passenger cabin. There are regulations for the cockpit which apparently don't mean very much as virtually every recent disaster has been plagued with smoke filled cockpits where pilots have been unable to see,or breath for that matter.

For the FAA to entone that the foregoing "efforts show a dedicated effort...to markedly reduce the fire hazards on aircraft" is quite frankly a bunch of premedicated nonsense. The way I know the FAA is that as soon as there is some heat put on them in the form of a disaster they get the same old experiments out and dust them off to show the world that they are "researching" in the relevant area.

For Mr. Helms, as Administrator of the FAA, to say that he does "not find a need to provide protection for passengers against toxic fumes",is unconscionable. Moreover, his statement clearly demonstrates that even though the FAA is apparently squandering taxpayer's money on research in the area, he has no intention of doing anything with the research. Moreover, I guess it explains the reception our efforts to provide protection have received. Mr. Helms believes his efforts, as described in his letter "are sufficient...to provide the level of safety as envisaged in the FAR..." What he does not say is that the FARs are so archaic and outdated, in many cases, that they have no relevance in the jet age era. For instance, I recall one of the regulations relating to ventilation mention about louvers on board aircraft. This is still an applicable regulation yet louvers disappeared along with the flying boats many, many years ago. What we should be concered with is meaningful safety and protection within the current state of the art and in recognition of the known hazards. - If crew members need respiratory protection when they are encapsuled and captive in a life support system then obviously so do passengers, be they the owners of the airline, congressmen, senators or just plain folks.

In response to Mr. Helms' statement in the paragraph which begins "Concerning your witness..." I have enclosed herewith copies of communications between ourselves and the FAA. However, before I briefly describe the enclosed materials, please note that the FAA first of all has no intention of regulating or requiring protective breathing equipment, therefore, they would have little desire to approve any devices in the area.

Moreover, "the requirements for obtaining FAA approval..." referred to by Mr. Helms are the most complicated ones one could imagine. The procedures are outlined in the enclosed documentation. The fact of the matter is the equipment could be approved and installed on the basis of a Service Bulletin which takes a matter of days as opposed to a matter of months or years to comply with the requirements that Mr. Helms refers to.

Mr. Helms further states that the FAA "requirements include the submittal of design and test data to substantiate compliance with the applicable airworthiness standards". There are no such standards so why are we being asked to submit design and test data to show compliance?

As to Mr. Helm's last sentence in the paragraph,the FAA has, as I mentioned in my testimony, provided us a procedure which will permit installation of certain of the PELS equipment on board aircraft. However, in this regard please note the letters from Keith Anderson, FAA Los Angeles, dated February 22, 1982 and Jennings O. Larson, FAA Honolulu, March 30, 1982. What they are referring to are the PELS units that connect to the fresh air outlets. Any other installations must be made under a supplementary type certification procedure. By analogy and in perspective, it is as if I told you you must come to Honolulu if you want pineapples when, in fact, you can buy them at your local supermarket.- We are informed that installation can be accomplished by means of a simple Service Bulletin. Yet this is not suggested or recommended by the FAA.

I hope the foregoing adequately explains the problems we have had and our position on the matter. The bottom line is: The FAA based on the statements by Lynn Helms himself, does not appear to be interested in providing toxic fume protection for passengers so anybody seeking approval on such a device, systems, or methods is given the run-around.

Quite frankly Jack, Based on the contradictory statements made by the FAA at the Senate Aviation Subcommittee Hearing, November 9, coupled with the answers you have flushed out of the FAA, I find that at least some individuals in the FAA are outrightly contemptuous to the Congress not to mention the fact that their right hand doesn't know what the left hand is doing - Lynn Helms tells your Committee that they are going to do nothing on the smoke protection for passengers beyond the useless oxygem masks which presently are installed on aircraft. At the same time, they are telling the Senate Aviation Subcommittee that they have ongoing efforts in the area. The ATA reinforced that by saying that work was being accomplished towards protective breathing equipment for passengers by the FAA.

To go one step further careful review of NTSB records and actions relating to the Air Canada disaster compared with FAA action, in my mind definitely reflects some "hand holding" that shouldn't be. For instance in a "human factors" report by the NTSB , a lengthy dissertation is made on which seats burned how much, yet at the same time no mention is made of the pilots action of turning off the life support system for the passengers nor as one finds in the most recent recommendation (31 October 1983) by the NTSB is there any mention of a recommendation for emergency instructions for passengers of what to do during in flight smoke and fire emergencies even though 23 people were just asphyxiated. Nor did the NTSB make any quantitative recommendation of the amount of fire extinguishing agents that should be present to adequately fight a fire. The token, half-hearted recommendation to "study" the matter of passenger protective breathing devices is unacceptable as a meaningful recommendation - these things have been studied for years.

Although it would appear that some small steps in the right direction are taken, I am dismayed to see that it appears the FAA is whistling the tune and the NTSB is dancing to it. Who's writing the music for the FAA? - we all know.

Again, I appreciate your continued efforts. I look forward to seeing you again in the near future. I am sorry I missed you during my last trip to Washington.

By the way, I did read through the transcript from the hearings where you had deSteiguer and others testify. I would like to discuss with you clarification of some matters there. Is is possible for me to obtain a copy of that transcript?

Kindest personal regards,

Bertil Werjefelt
President

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
NORTHWEST REGION
LOS ANGELES AREA AIRCRAFT CERTIFICATION OFFICE
4344 DONALD DOUGLAS DRIVE
LONG BEACH, CALIFORNIA 90808

FEB 22 1982

In Reply
Refer To: ANM-130L

Xenex Corporation
ATTN: Bertil Werjefelt, President
1400 Kapiolani Boulevard, Suite C-4
Honolulu, Hawaii 96814

Gentlemen:

We are now able to advise you regarding the extent of FAA involvement with Xenex protective breathing equipment and this letter is the response promised in our letter to you of November 30, 1981, and in Administrator Helms' letter to you of January 29, 1982.

The Xenex Model 200, which we understand may be carried on-board individually and requires no permanent change to the aircraft, is not within the purview of the FAA. As no FAA approval is to be granted, there must be no FAA approval implied or stated by you. If the Model 200 is "installed" in an aircraft, either for storage or in any other way, an FAA Maintenance Inspector must evaluate that installation to assure that no hazard to safety is introduced by that installation. The Maintenance Inspector will determine the appropriate means of indicating approval of the specific installation.

Other Xenex models, which we understand are to be installed permanently, must be evaluated and approved under either Type Certification procedures in the case of incorporation into new aircraft design, or under Supplemental Type Certificate procedures in the case of retrofit into existing, inservice aircraft. In either case, each separate approval would apply to a separate model of aircraft. Application may be made to an FAA Regional Office, as was described in our letter of September 14, 1981, to you.

The Technical Standard Order process does not apply, as no TSO exists for the equipment.

Sincerely,

Donald Anderson

for KEITH D. ANDERSON
Chief, Los Angeles Area
Aircraft Certification Office

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

Flight Standards District Office
218 Lagoon Drive, Room 215
Honolulu, Hawaii 96819

March 30, 1982

Mr. Bertil Werjefelt
President, Xenex Corporation
1400 Kapiolani Blvd, Suite C-4
Honolulu, HI 96814

Dear Mr. Werjefelt:

We have reviewed all the information you supplied in support of your request to have locations approved for storage of the Xenex Portable Emergency Life Support Systems.

We understand the Series 200 model does not require any change to the aircraft design.

Of the locations you outline in your letter of March 8, we would prefer the overhead storage compartments for passengers' life support systems to include restraint as preferable to loose storage. For the cockpit crew, any container would be acceptable so long as it does not block other equipment. We would also want to evaluate any site the carrier proposes.

Your communications with a carrier must not indicate that the Federal Aviation Administration is endorsing your product. Also, there must be no indication that there is any regulatory requirement for this device. Our preference of storage areas would only apply to the local carriers for which this office has certificate responsibility. Any request for installation of storage means for the life support system must come from the carrier involved.

We believe this covers the areas outlined in your letter. If you need more information please let us know. There is very little we can do at this level on any of the other models your company is developing.

Sincerely,

Jennings O Larson

Jennings O. Larson
Chief

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

OFFICE OF
THE ADMINISTRATOR

January 29, 1982

Mr. Bertil Werjefelt
President, Xenex Corporation
1400 Kapiolani Boulevard
Suite C-4
Honolulu, Hawaii 96814

Dear Mr. Werjefelt:

This is in reply to your December 16, 1981, letter in which you seek my personal intervention, assistance, and response to matters disclosed in the enclosures to your letter. Regulatory Docket No. 20351, which denied your petition, contains voluminous comments and analysis and for the most part provides an adequate response to the first paragraph of your letter.

The supplemental type certificate (STC) procedures outlined in the September 14, 1981, letter from Mr. Hugh Waterman of our Long Beach office, Northwest Mountain Region, provide the necessary information you need to make an STC application for those Portable Emergency Life Support (PELS) systems which require modification to the aircraft. I have asked the Northwest Mountain Region Certification Directorate to review your PELS Series 200 system, which does not require modification to the aircraft. This region is the Certification Directorate responsible for your geographical area. It will assess the necessity of the Federal Aviation Administration's approval, the system's compatibility with the aircraft ventilation system, and its effect on passengers in the cabin. I have also asked for an expeditious direct reply to you on this matter.

Sincerely,

J. Lynn Helms
Administrator

XENEX CORPORATION

23 March 1982

Attention: Jennings O. Larson, Chief
Flight Standards Dictrict Office
FEDERAL AVIATION ADMINISTRATION
218 Lagoon Drive, Room 215
Honolulu, Hawaii 96819

RE: Our Phone Conversation Today's Date and our Letter to
Mr. Hoffman dated 8 March 1982

Dear Mr. Larson:

Per your request, we have enclosed herewith relevant communications with the FAA concerning our letter to Mr. Hoffman of 8 March 1982. You will note our request for assistance of 18 December 1981 from the FAA Administrator and his subsequent response to us of 29 January 1982.

In addition, as it concerns our communications with Mr. Hoffman, we have enclosed a letter from Keith D. Anderson, Chief, Los Angeles Area Aircraft Certification Office, dated 22 February 1982.

We trust these enclosures will be of assistance to you in response to our 8 March 1982 letter.

Very truly yours,

Bertil Werjefelt
President

BW:md

Enclosures: Letter from Keith D. Anderson 2/22/82
Letter from J. Lynn Helms 1/29/82
Letter from Xenex to J. Lynn Helms 12/18/81

XENEX CORPORATION

8 March 1982

Mr. Hugo Hofmann
Chief Maintenance Branch
FEDERAL AVIATION ADMINISTRATION
Pacific Western Region
218 Lagoon Drive
Honolulu, Hawaii 96819

RE: Installation and Placement of Xenex Portable Emergency Life Support Systems (Xenex PELS) Series 200

Dear Mr. Hofmann:

Pertaining to the above referenced matter and our discussions last Friday, we propose placement of the Xenex PELS units in the following areas and by the following means:

A. Underneath the passenger seat next to the life vest, by identical or comparable means to that which secures and stores life vests.

B. Underneath the seat in front of the passenger, by identical or comparable means to that which secures and stores life vests.

C. In the overhead storage compartments, properly secured as, for instance, the life vests are stored underneath the seat.

D. Loosely stored in the overhead compartments where such compartments have doors to secure items stored in this area.

E. In a small separate compartment within the overhead compartment, where such compartments have doors to secure items stored in this area.

F. For the cockpit crew: Stowed in their coat closet in an appropriate container attached to the floor, wall or coat hanger bar.

As mentioned to you, the individual Xenex PELS units, for passenger use, weigh approximately one pound each. The weight varies slightly depending on the specific components selected by the airlines. A heavy duty version of the Series 200, for crew use, weighs approximatey three pounds.

We would appreciate your early reply concerning the suitability of the aforementioned installations, A thru F,for the Xenex PELS units.

Sincerely,

Bertil Werjefelt
President

BW:md

XENEX CORPORATION

18 December 1981

The Honorable J. Lynn Helms
Administrator
FEDERAL AVIATION ADMINISTRATION
800 Independence S.W.
Washington D.C. 20591

Dear Mr. Helms:

We are writing this letter to you to seek your personal intervention, assistance and response pertaining to the matters disclosed in the enclosed materials. The enclosures call attention to serious health and safety deficiencies concerning not only protection against smoke and toxic fumes for passengers and crew, but also fresh air ventilation and pressurization practices in the commercial transport sector of the aviation industry.

As is evident from Exhibit 10 there apparently is a gross absence of policy and/or direction within the FAA concerning the serious safety issues of smoke and toxic fume protection. Although our company previously has been given approvals from the FAA to install the Xenex Emergency Life Support Systems on board U.S. transport aircraft, this position was recently reversed. A denial by the FAA to permit installation of this direly needed and long sought after safety equipment is apparently based on the premise that installation of emergency and safety equipment on board aircraft (for use by the public) not required by law, is a policy decision matter within the FAA.

We understand the Lead Region Staff in Seattle is looking into the matter, however, we have been given no indication of when they will reach a decision.

For at least the last two decades, considerable sums of money have been expended by FAA and private industry on research to eliminate the problem. Viable solutions presently exist, however, cannot be implemented until the FAA takes action. We believe the problem is of national importance and will require your offices' direct involvement to achieve an appropriate and timely decision on these matters.

The FAA, which is empowered to promote aviation safety, is currently on record as refusing to permit installation of the Xenex Portable Emergency Life Support (PELS) Systems as smoke and toxic fume protective breathing equipment for passengers and crew. We are asking your personal involvement and response in correcting this situation. We look forward to your early reply.

Sincerely,

Bertil Werjefelt
President

BW:md

XENEX CORPORATION

19 November 1981

SPECIAL DELIVERY

Mr. Keith Anderson
Chief, Los Angeles Area
Aircraft Certification Office
FEDERAL AVIATION ADMINISTRATION ANM-100L
4344 Donald Douglas Drive
Long Beach, California 90808

RE: Your phone call 18 November 1981 Concerning Installation of Toxic Fume Protective Breathing Equipment for Passengers and Crew Members - Clarification of FAA Policy and Approval Methods.

Dear Mr. Anderson:

Thank you for your phone call concerning the above referenced matter. I have enclosed herewith copies of pertinent materials and communications evidencing the Catch-22 situation we are subjected to by the FAA in our efforts to improve a grossly neglected area in aviation safety - toxic fume protection for passengers and crew. Following is a summary of the sequence of events leading to the FAA's refusal to permit installation of direly needed safety equipment on board aircraft.

1. In a meeting with Mr. Charles R. Foster, Director Northwest Region FAA, in February of 1981, he confirmed that some of the automatic Xenex systems required conventional STC approval. However, it was clearly stated that our Series 200 (not designated so at the time) which is a system that connects to the fresh air outlets, could be installed on board aircraft without FAA approval. This was confirmed in a letter dated 4 March 1981 to Mr. Foster (Exhibit "A" attached).

2. Xenex Corp. subsequently proceeded with prototype work, final design and arrangement for the manufacture of the 200 Series.

3. Xenex Corp. in the course of several meetings and by letter dated 4 September 1981 to Mr. Hugh E. Waterman, Chief, Systems and Equipment Branch FAA ANW-130L, requested approval for some of our automatic systems, installation of which concern TSO and STC requirements for approval (Exhibit "B" attached).

4. In a letter from the FAA by Mr. Waterman, dated 14 September 1981, to Xenex detail procedure for approval of our automatic systems by means of an STC were disclosed to us (Exhibit "C" attached). The letter improperly inferred that the Xenex Series 200 system was also to be approved by the STC method.

- continued -

5. In a letter from Xenex Corp. to Mr. Waterman, dated 21 October 1981 (Exhibit "D" attached), Xenex asked for confirmation that the Xenex Portable Emergency Life Support System (Xenex PELS) Series 200 is excluded from the STC procedure.

6. In a letter from the FAA by Mr. Waterman to Xenex Corp. dated 2 November 1981 (Exhibit "E" attached), we are informed that contrary to Exhibit "A", the Xenex PELS Series 200 may be approved by a field inspector under a simple form 337 procedure. It is, however, pointed out that this form is normally for one aircraft only.

7. Xenex Corp., based on the information in Exhibit "E", had several discussions during the week of 9 November 1981 in Honolulu with FAA's Gary K. Nakagawa, Chief, Airworthiness District Office APC 210 (Exhibit "F" attached). Mr. Nakagawa refused approval under the form 337 procedure for the Xenex PELS Series 200 system. Mr. Nakagawa contends, among other things, that installation of new types of emergency equipment, not required by law, on board aircraft is a policy decision to be decided by higher authorities in the FAA, not an inspector in the field. (Letter 19 Nov. 1981)

The foregoing sequence of events is a classic case of Catch-22 wherein the actions of the FAA are a detriment to improved aviation safety. It would appear from our above outlined experience that it may not be possible for an airline to obtain FAA approval to improve safety in order to protect its passengers and crew from smoke and toxic fumes. If, in fact, as stated by Mr. Nakagawa that no action can be taken until "higher authorities in the FAA" arrive at some policy decision then it would appear that our efforts to date to obtain STC and TSO approval have been futile and the substantial sums of money and time that our company has invested in the development of those products may have been for naught as a result of misleading actions on the part of the FAA.

Who should we believe in this matter - Mr. Foster, who says no approval is necessary? Mr. Waterman who states that a simple form 337 procedure is all that's necessary? Or Mr. Nakagawa who states that neither of the above is correct, rather FAA in Washington must come to some further policy decision before any approvals can be granted?

Our patience is at an extremely low ebb for what we believe are good reasons. It has been almost a year since Xenex asked the FAA to take action on the serious fire and smoke hazards confronting passengers on aircraft. The problem has been known to the FAA for decades and no action has heretofore been taken. You may be aware that Xenex in 1980 filed a petition to improve health and safety problems on board aircraft. This petition was denied.

Mr, Keith Anderson
FEDERAL AVIATION ADMINISTRATION 19 November 1981

In a letter to Mr. Langhorne Bond, then Administrator of the FAA, dated 22 December 1980 (Exhibit "G" attached), we requested information pertaining to our petition (FAA Docket 20351) concerning protection against smoke or fire on board aircraft. In response to our letter of 22 December 1980, Xenex received a letter from the FAA dated 12 January 1981 assuring us that the serious smoke and fire issues "would be included in the FAA consideration of your petiton" (Exhibit "H" attached). The letter was from Mr. Jerry Chavkin, Chief, Aircraft Engineering Division, Office of Airworthiness, Washington D.C. Subsequent to these communications and several other communications by ourselves and other parties with the FAA, Mr. Charles E. Weithoner, Acting Administrator of the FAA, on 3 March 1981 denied the petition for rulemaking without so much as mentioning the smoke and fire issues under the scope of our petition (Exhibit "I" attached). This action was in direct contradiction to that which we had theretofore repeatedly been told verbally and in writing.

In the face of more than 600 fatalities due to asphyxiation on American made aircraft in less than 2 years, the public and the airline industry is looking to the FAA for guidance and direction. So are we. It is obvious from the foregoing that such guidance and direction has not been provided to date by the FAA nor is there any indication of when it will be forthcoming. One would hope that it will not take a tragic disaster at National Airport in Washington for the FAA to open its eyes.

As explained to you, the Catch 22 situation is very costly to our company. We have viable solutions to problems that industry has recognized for more than 20 years. It is not expensive and there is no reason why it should not be implemented industrywide. We have been repeatedly frustrated in our efforts to improve aviation safety.

We have been verbally informed by the FAA that it is considering issuing an Advisory Circular and a subsequent Airworthiness Directive in order to improve aviation safety as it concerns smoke and fire on board aircraft. Based on our experience to date, it is difficult to believe that such action would be taken within the near future.

We have made every effort to work within the FAA guidelines to obtain approval for our 200 Series, only to find that perhaps no such "guidelines" exist. We were willing to take the extra step and go thru a form 337 approval procedure despite the fact that Mr. Foster told us that no approval was necessary.
Now that we are ready to proceed with installations we are informed by a local field office that even the form 337 procedure is unacceptable to the FAA. As we stated earlier we have serious question of where direction is coming from within the FAA, if in fact any direction, or policy, for that matter exists.

Mr. Keith Anderson
FEDERAL AVIATION ADMINISTRATION 19 November 1981

We would hope you will understand our frustration in these and related matters and will be able to quickly provide concise answers so that we may proceed with our sales and installations of these products which will greatly improve airline safety in this long neglected area. We have patiently awaited FAA action before taking our product directly to the public for sale to individual passengers and crewmembers. Obviously, if passengers begin carrying on board their own safety equipment this would cause serious embarrassment to the FAA, aircraft manufacturers, and the airline industry in general for their lack of appropriate exercise of fundamental responsibility and, seriously erode the public trust and confidence in air travel safety which government and industry have worked so hard to establish. It is not our desire to take the direct sales approach, but the FAA's actions, or lack thereof may leave us no alternative.

I look forward to meeting with you on the 24th at which time we can discuss this untenable situation in further detail. I hope, by that time, your personal involvement in these matters will provide positive results.

Sincerely,

Bertil Werjefelt
President

BW:md

Enclosures: Exhibits "A" thru "I"

XENEX CORPORATION

4 March 1981

Mr. Charles R. Foster
Director, Northwest Region
FAA - Boeing Field
King County Intl. Airport
Seattle, Washington 98108

Dear Mr. Foster:

I much enjoyed our meeting week before last concerning the Xenex Portable Emergency Life Support System (PELS System). Your comments, advice and encouragement were carefully noted and sincerely appreciated.

As I understand from our discussion, the use of the Xenex PELS System on board aircraft, can to a substantial degree, be effected by the airlines themselves without FAA approval, so long as there are no modifications made to the existing aircraft structure or systems per se. Since our systems comprise a fresh air supply source in conjunction with a face mask and/or air storage bladder systems, it is apparent that a large number of aircraft can readily use the Xenex PELS System with essentially no modification whatsoever to the aircraft or its systems. Other aircraft, which are not equipped to provide passengers with an individual fresh air source, would require modifications and consequent approval of such modification by the FAA, in order to facilitate the use of the Xenex PELS System. Such modification and request for FAA approval and supplementary type certification would be initiated by the respective airlines.

It is a fact that there are virtually no instructions whatsoever on board passenger carrying aircraft advising the traveling public of what to do in case of smoke or fire emergencies in flight. A further fact is that a large number of fatalities, relating to smoke or fire on board aircraft, are attributed to asphyxiation rather than burning. The need for safety improvements is painfully obvious. We welcome the support of the FAA in implementing the Xenex system in an effort to substantially improve safety.

If my understanding of our discussion, reflected above, is nct correct, I would appreciate your further comment.

Very truly yours,

Bertil Werjefelt

Bertil Werjefelt
President

XENEX CORPORATION

4 September 1981

SPECIAL DELIVERY

Mr. Hugh E. Waterman
Chief, Systems and Equipment Branch
FAA ANW-130L
4344 Donald Douglas Drive
Long Beach, California 90808

RE: Request for Letter of Approval; Xenex Corp. statement of Conformance of Xenex Portable Emergency Life Support (PELS) Systems and Xenex Stationary Emergency Life Support (SELS) Systems to TSO-C64

Dear Mr. Waterman:

Subject to our previous meeting and phone conversation, we are hereby requesting formal approval of modifications to oxygen mask assembly, continuous flow, passenger, for use in air carrier aircraft, TSO-C64.

As previously explained, and as is apparent from enclosed drawings Ref. Nos./Origin 780900, 1 thru 6 of 15, describing Xenex Emergency Life Support Systems Seris 100 thru 400 (Series 200 does not fall within the TSO requiements), the modifications are additions to the existing TSO-C64 equipment. Tests and investigations reveal that the modifications do not alter or impede the performance of the passenger oxygen mask assembly, under the regulatory requirements, to supply the user with certain quantities of oxygen and ambient air.

The purpose for the modifications is to provide protection for passengers against smoke, toxic fume and asphyxiation hazards, with the same equipment required under the FARs for supplementary oxygen, utilizing the additional components described in the drawings.

All modification components are and will be made of materials that conform to the regulatory requirements for flammability, toxic fume emissions from combustion, etc.

Hoses and valve openings utilized in connection with the ambient air intake valve (B) of the mask assembly are all of appropriate dimensions so as not to impede the air used for dilution in the mask. In addition, I call your attention to the optional valve assembly (F) which permits the user discretion to use either static ambient air or ducted pressurized air (.3" to .5" of water commonly) as the dilution gas source when utilizing the entire assembly for the purposes set forth under TSO-C64. It is recommended that when the optional valve (F) is used, the entire assembly be presented to the user with the valve opened to the static ambient port. If the need for smoke protection arises, this static ambient port is closed allowing only ducted, pressurized air through the hose and into the mask. Further, when using the PELS System for a prolonged period (more than 8 minutes) for smoke protection, where there is minimal duct pressure, an overflow valve (J) is provided in order to vent excess CO_2 from the rebreathing bag. The CO_2 would otherwise escape from the mask due to normal positive pressure.

Although valve and disconnect assemblies on the drawings are positioned below the bag, they can obviously be positioned anywhere up to and including the mask.

Xenex Corporation certifies, that based on our tests and investigations, modified articles, Xenex SELS Series 100 and Xenex PELS Series 300 and 400 meet all requirements of TSO-C64. We respectfully, therefore, ask for your letter of approval.

Sincerely,

Bertil Werjefelt
President

BW:md

Enclosures

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
NORTHWEST REGION
LOS ANGELES AREA AIRCRAFT CERTIFICATION OFFICE
4344 DONALD DOUGLAS DRIVE
LONG BEACH, CALIFORNIA 90808

SEP 14 1981

In Reply
Refer To: ANW-130L:FL

Xenex Corporation
1400 Kapiolani Boulevard
Suite C-4
Honolulu, Hawaii 96814

Attention: Mr. B. Werjefelt
President

Gentlemen:

Xenex Portable and Stationary Emergency Life Support Systems

This is in reply to your letter dated September 4, 1981 which transmitted preliminary drawings for the Xenex portable and stationary emergency life support systems.

We have conducted a cursory review of the preliminary drawings and not on any test data and find that the general principles of the support systems appear acceptable. However; it should be noted that final approval of the support systems is contingent on the issuance of a Supplemental Type Certificate (STC) for the installation of these systems in an aircraft. The normal procedure for obtaining an STC would include the following:

a) Submittal of an Application for STC, FAA Form 8110-12 (copies attached).

b) Submittal of all detailed drawings including process and procurement specifications for the support systems and for the modifications made to the aircraft.

c) Submittal of installation instructions.

d) Submittal of substantiating data which shows the modification and installation of the systems complies with the applicable Federal Aviation Regulations (FAR). This would consist of test reports, computation and analysis.

e) The necessary functional, proof and operational tests for the systems must be conducted, it is suggested that a test proposal be submitted before conducting the tests. It should be noted that all official tests will be witnessed by an FAA engineer unless prior authorization is obtained to the contrary.

f) FAA conformity inspection of the systems and installation must be conducted.

If you have any other questions, please contact this office, telephone number (213)548-2831 or our FAA office in Honolulu, Hawaii, telephone number (808)546-0340.

Sincerely,

Frederick Lee

For Hugh E. Waterman
Chief, Systems and Equipment Branch

Enclosures

XENEX CORPORATION

21 October 1981

Mr. Hugh E. Waterman, Chief
Systems and Equipment Branch
Department of Transportation
FEDERAL AVIATION ADMINISTRATION
4344 Donald Douglas Drive
Long Beach, California 90808

Dear Mr. Waterman:

Your letter of Seprember 14, 1981 does not make clear the fact that the Series 200 Xenex Portable Emergency Life Support System is not subject to STC approval. The Series 200, as you know, is stored in a seat back, underneath a seat, or other appropriate place. This system is user activated by means of connecting the end of the hose to the fresh air outlet.

We would appreciate your confirmation of this matter at your early convenience.

Very truly yours,

Bertil Werjefelt

Bertil Werjefelt
President

BW:md

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
NORTHWEST REGION
LOS ANGELES AREA AIRCRAFT CERTIFICATION OFFICE
4344 DONALD DOUGLAS DRIVE
LONG BEACH, CALIFORNIA 90808

NOV 2 1981

In Reply
Refer To: ANM-131L

Xenex Corporation
ATTN: Bertil Werjefelt, President
1400 Kapiolani Boulevard, Suite C-4
Honolulu, Hawaii 96814

Gentlemen:

This is in reply to your letter dated October 21, 1981, concerning your Xenex Portable Emergency Life Support System Series 200.

The installation of this system may be approved by the FAA Form 337 method at the discretion of the inspector in lieu of a Supplemental Type Certificate (STC). However, it should be noted that the FAA Form 337 approval is normally for one airplane only.

Sincerely,

Frederick Lee
For H. E. WATERMAN
Chief, Systems & Equipment Branch

XENEX CORPORATION

19 November 1981

Mr. Gary K. Nakagawa
Chief Airworthiness Dist. Office
FEDERAL AVIATION ADMINISTRATION APC 210
300 Ala Moana Blvd.
Honolulu, Hawaii 96850

RE: Form 337 Procedure for Approval of Xenex Portable Emergency Life Support System Series 200

Dear Mr. Nakagawa:

I wish to confirm our several discussions during the week of November 9 concerning the above referenced matter.

You informed us that you would not approve our Xenex PELS Series 200 for installation on board aircraft under the form 337 procedure. Among your reasons for refusing approval you contend that the installation of emergency equipment,not required by law,on board aircraft, is a policy decision matter of higher authorities within the FAA. I will, therefore, pursue this matter with higher authorities within the FAA.

Very truly yours,

Bertil Werjefelt
President

BW:md

XENEX CORPORATION

22 December 80

SPECIAL DELIVERY - RETURN RECEIPT

Mr. Langhorne Bond
Administrator
FEDERAL AVIATION ADMINISTRATION
800 Independence Ave., S.W.
Washington, D.C. 20591

RE: Your 11 December 1980 letter to Congressman Cecil Heftel concerning Docket 20351, PR80-10

Dear Mr. Bond:

We have received, from the FAA, a copy of the above referenced letter. We are pleased to learn that an FAA decision on Docket 20351 will be forthcoming shortly. In the meantime, however, your letter to Congressman Heftel leads us to believe that the FAA is viewing the air quality standards issue, brought forth in our petition, primarily from the normal operations, medical standpoint. Air quality standards obviously also encompass abnormal operations, such as when there is smoke or fire on board.

We have taken for granted that the FAA's considerations relating to our petition for rulemaking encompass normal as well as abnormal operations. We would appreciate if you would advise us at your early convenience if the abnormal operations are also a part of your considerations and in this regard, what significance you attribute to them, relative to normal operations.

Sincerely,

Bertil Werjefelt
President

BW:md

cc: Congressman Cecil Heftel

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

WASHINGTON, D.C. 20591

January 12, 1981

Mr. Bertil Werjefelt
President
Xenex Corporation
1400 Kapiolani Boulevard, Suite C-4
Honolulu, HI 96814

Dear Mr. Werjefelt:

Your letter of December 22, 1980, to Mr. Langhorne Bond concerning your petition for rulemaking (Docket Number 20351) pertaining to air quality standards was referred to my office for answering.

You asked if Federal Aviation Administration (FAA) consideration of your petition would include normal operating conditions as well as abnormal operating conditions, such as smoke and fire. Since your petition for rulemaking did address the ventilation rules, which include FAR 25.831(d), those requirements would be included in the FAA consideration of your petition. Should you wish to address more than FAR 25.831(d) your petition would require amendment, republishing in Federal Register for comment and after the comment period, evaluation of the public comments. This would result in considerable delay in the current processing of your petition.

Unless advised otherwise, the FAA will continue processing the current petition.

Sincerely,

Jerry Chavkin
Chief, Aircraft Engineering Division
Office of Airworthiness

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
WASHINGTON, D.C. 20591

* *

In the matter of the petition of

XENEX CORPORATION

to amend Sections 25.831 and
121.219 of the Federal Aviation
Regulations

* *

Regulatory Docket No. 20351

DENIAL OF PETITION

By letters dated May 8 and May 23, 1980, Bertil Werjefelt, President, Xenex Corporation, 1400 Kapiolani Blvd., Suite C-4, Honolulu, Hawaii 96814, petitioned the Federal Aviation Administration (FAA) to amend §§ 25.831 and 121.219 of the Federal Aviation Regulations (FAR) to improve airplane passenger and crew compartment air quality standards.

Section 25.831 states, in pertinent part, that each passenger and crew compartment must be ventilated and that each crewmember must have at least 10 cubic feet of fresh air per minute. Also, passenger and crew compartment air must be free of harmful or hazardous concentrations of gases or vapors. Maximum permissible concentrations of carbon monoxide and carbon dioxide are specified.

Section 121.219 states, in pertinent part, that passenger and crew compartments must be suitably ventilated and fuel fumes may not be present and also specifies a maximum carbon monoxide concentration of one part in 20,000 parts of air.

In support of its petition, Xenex Corporation (Xenex) presents a number of arguments which are discussed in the following paragraphs.

The petitioner contends that crew and passengers are subjected to health hazards while flying as a result of inadequate ventilation. In addition, fresh air ventilation rates on board airplanes carrying passengers are only 10 to 20 percent of the "fresh air ventilation" required by law for minimum acceptable indoor air quality in a nonaviation environment. The petitioner does not substantiate the health hazards to which it believes the crew and passengers are being subjected, nor does it provide information regarding the extent of the health problems being encountered. The petitioner does not explain how it arrived at the conclusion that passenger-carrying airplane ventilation is only 10 to 20 percent of that required by law for nonaviation environments. The petitioner also fails to identify the law to which the reference is made.

Xenex claims that the ventilation recommended by the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) for indoor nonaviation environments should apply to passenger transport aircraft. The petitioner fails to explain why another ASHRAE standard which contains recommended ventilation 1/standards for passenger transport aircraft should not be used. ASHRAE 1978 Applications Handbook, Chapter 9—Aircraft, states in part, "A portion of the cabin air may be recirculated, but it should be filtered and purified if it is a large percentage of total ventilation or unless it is recirculated for limited times only. The recommended ventilation rate is 2.4 liters per second (l/s) per passenger and 14.2 l/s for cockpit crew members." The recommended ventilation rate of 2.4 l/s equates to approximately 5 cubic feet per minute (cfm), and 14.2 l/s is approximately 30 cfm. The current rule requires for each crewmember a minimum of 10 cfm of fresh air plus additional ventilation to perform his or her duties without undue discomfort or fatigue. A review of the ventilating characteristics of the crew cabin in seven current transport airplanes reveals that the minimum ventilation rates vary from 70 to 150 cfm per crewmember with air changes ranging from 20 to 87.8 per hour which exceeds the ASHRAE recommendation.

Xenex proposes fresh air ventilation at 35 to 65 cfm/person. The petitioner does not provide justification for such large quantities of fresh air flow. For buses and trains, the ASHRAE indicates that 20 to 25 percent outdoor air is adequate. Even using the minimum recommended ventilation for cocktail lounges (30 cfm/person) as an appropriate standard for transport aircraft, it would require only 6 to 7-1/2 cfm/person of fresh air rather than 35 to 65 cfm/person as proposed. The petitioner proposes that filtered recirculated air shall never exceed 7 cfm/person. No support for this proposal is included in the petition.

A review of the ventilating characteristics of seven current transport airplanes reveals that the ventilation varies from 15.2 to 25.7 cfm/person in the passenger cabin or 3 to 5 times that recommended by ASHRAE. When cabin air is recirculated in these airplanes, appropriate air conditioning is accomplished.

The petitioner proposes that uncontrolled aircraft leakage be less than 20 percent. The proposal is not clear because the petitioner does not indicate what criteria requires that the leakage must be less than 20 percent.

1/Ventilation. The process of supplying or receiving air by natural or mechanical means, to or from any space. Such air may or may not have been conditioned. AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR CONDITIONING ENGINEERS—HANDBOOK OF FUNDAMENTALS, TERMINOLOGY.

Xenex proposes that contaminants be limited to 0.1 of the threshold limit values as established by the American Conference of Governmental Industrial Hygienists. Xenex proposes that cabin air be monitored for contamination caused by pathogens. Pathogens are any micro-organisms or viruses that can cause disease. No justification for this proposal is presented, nor is the action identified which is to be taken by an air carrier if such monitoring is instituted.

The petitioner proposes that the air on board shall be free of offensive odors. The issue of offensive odors involves subjective evaluation and is not an issue for which safety rulemaking is appropriate.

Xenex proposes that, at all times, the relative humidity in aircraft cabins be maintained between 30 and 50 percent. It is also proposed that water used to humidify the cabin be free of organic and chemical compounds in accordance with acceptable public health standards for potable water as defined by the American Conference of Governmental Industrial Hygienists. Xenex further proposes that the vapor in the air on board transport aircraft shall be composed of no more than 20 percent unsterilized perspiration and expiration originating from occupants on board.

Xenex fails to show that there is a physiological need for such high levels of humidification during flight. Although human comfort may be affected by humidity, no evidence is presented by the petitioner to allow the conclusion that humidity, or lack of it, causes health problems in normally healthy people. Regarding the purity of water used for humidification, the petitioner has not shown that the quality of water used in humidifying systems has ever affected passenger or crew safety. The petitioner's proposal that water vapor not be more than 20 percent unsterilized perspiration and expiration is not supported. No evidence was found that such a requirement exists or is needed today for persons in any environment.

The Federal Aviation Administration published the Xenex Corporation petition for rulemaking, verbatim, for public comment, in the Federal Register (45 FR 41962) on June 23, 1980. All communications received on or before August 22, 1980, were considered by the Administrator before this action was taken. The FAA received comments from 29 individuals, organizations, and companies in response to the petition. The majority of these supported either the petition or the intent of the petition without taking a position on the particular levels for humidity, contaminants, or fresh air circulation rates. Two commenters cite illnesses, flu, and chicken pox, contracted after an airline flight, which they attributed to poor air quality on the airplanes. Several comments were made that the fresh air ventilation standards for aircraft are not equal to those of other public or non-aviation environments. None of these comments were substantiated by information or data.

There were comments from five organizations and companies opposed to the petition. The Aerospace Industries Association, (AIA) contends that implementing the proposal would cost the airlines $633 million per year for the Boeing 727 aircraft fleet and $1.319 billion per year for the Boeing 747 aircraft fleet. This contention was supported by a detailed cost analysis. In addition, data were submitted which show that the ventilation rates and number of outdoor air changes per hour for seven different air carrier aircraft exceeds the most stringent recommendations for public gathering places, specifically night clubs.

The petitioner submitted a general rebuttal to the cost estimate from the AIA. However, while recognizing that the proposals would be costly, the petitioner did not offer any counter cost estimates nor did it present data to show that any retrofit of additional equipment is justified in the interest of aviation safety. In this connection, it may be noted that FAA regulations do not preclude installation of additional air conditioning, filtering, and humidifying equipment that meets airworthiness standards should an airline elect to do so in the interest of increasing passenger comfort.

In consideration of the foregoing, I find that the petition does not justify instituting the rulemaking procedures requested by the petitioner. Therefore, in accordance with rulemaking procedures of Part 11 of the Federal Aviation Regulations, the petition of the Xenex Corporation to amend §§ 25.831 and 121.219 of the Federal Aviation Regulations is hereby denied.

Issued in Washington, D.C., on March 3, 1981.

Charles E. Weithoner

Charles E. Weithoner
Acting Administrator

The Honorable
Congressman Elliott Levitas
Chairman
Subcommittee on Investigations
and Oversight
Committee on Public Works and Transportation
B-376 Rayburn House Office Building
Washington, D.C. 20515

RE: Supplemental Materials Requested Concerning "Passenger Safety and Survivability in Airline Cabins", Hearings July 12-14, 1983 - Cost Calculations for the Carriage of Toxic Fume Protective Breathing Equipment on Board Airlines

Dear Congressman Levitas:

This letter is in reply to your request for supplemental information as referenced above.

The data which is provided herein is available in the manufacturer's technical publications. You will note that we have not submitted data for the 757 and 767 aircraft. However, the general fuel efficiency of these aircraft is approximately 30% better than, for instance, the 747 fitted with the older engines.

Calculations are based on pounds of fuel per hour per pound of added weight, 3,000 hour per year aircraft utilization.

Aircraft	Pounds of fuel per hour per pound of added weight
747	.050
L-1011	.0266
A-300	.0395
DC-10	.0253
707	.056

As an example, we have calculated the costs for a 747 with 442 seats based on an average trip of 3-hours and an average weight of the PELS System of 1/2 pound per unit which makes a total of 221 pounds of added weight. From this we find: 221 x 0.050 x 3 = 33.15 pounds of additional fuel. The poundage must be divided by approximately 6 to arrive at the number of gallons used to carry the extra weight. This amounts to slightly more than 5 gallons (33.15 ÷ 6). Current jet fuel prices range from 86¢ to $1.20 per gallon. We have, therefore, rounded out the figures to a total cost of approximately $6.00 (5 x $1.20). In addition, consideration must be given to the fact that aircraft may many times only be occupied to approximately 50%. (50% of 442 = 221). One must then divide the cost, $6.00 by 221 which, as you will note, is less than 3¢ per ticketed passenger. This is then the continuous ongoing cost of added fuel for carrying the equipment.

To the foregoing must be added the capital cost of the equipment which we, for the purpose of this example, have placed at $400.00 per unit (an absolute upper limit) for a total of $176,800.00. Further we will add an additional $200.00 for the purpose of installation, maintenance and inspection during the ten year lifetime of the equipment. We still presume a 50% occupancy rate equal to 221 passengers and 1,000 3-hour trips. We have not included interest or amortization as this will vary from airline to airline. However, we believe it is adequately covered in the $200.00 maintenance cost.

We find that 221 people (50% occupancy) make 1,000 3-hour trips per year for 10 years = 221 x 1000 x 10 - 2,210,000 ticketed passengers per aircraft over 10 years. Cost per aircraft therefore, is $400 + $200 = $600 x 442 = $265,200. Dividing this amount by 2,210,000 passengers equals 12 cents per passenger.

Thus, the total cost per ticketed passenger on flights of 3-hours is approximately 15¢ (12¢ + 3¢). Please note, however, that the average flight is much shorter than 3 hours. Therefore, the cost is even less - we estimate the average cost to be on the order of 5¢, especially when consideration is given to volume production as a means of reducing the $600 total equipment cost.

I trust the foregoing is sufficient for your purposes and that in light of the facts and problems and the concomitant insignificant costs for solutions to same, you will be further encouraged to continue your efforts for improvements in aviation safety.

Sincerely,

Bertil Werjefelt
President

Enclosure

[illegible] O'Hara
[illegible]

AVIATION SAFETY

(Aircraft Passenger Survivability and Cabin Safety)

WEDNESDAY, NOVEMBER 2, 1983

House of Representatives,
Subcommittee on Investigations and Oversight,
Committee on Public Works and Transportation,
Washington, DC.

The subcommittee met at 10:25 a.m., in room 2253, Rayburn House Office Building, Hon. Elliott H. Levitas (chairman of the subcommittee) presiding.

Mr. Levitas. The Subcommittee on Investigations and Oversight will please come to order.

Yesterday the subcommittee received a report from the Federal Aviation Administrator on the present status of the agency's cabin safety program and of the new direction being afforded the aircraft safety program.

I believe the exchange between the FAA Administrator and the members of the subcommittee clearly evidenced the concern of this subcommittee that we not be subjected to the all too familiar rhetoric which has been delivered from the witness table in earlier hearings and, at the same time, I know that we are impressed with the dedication which Mr. Helms brings to his task. It will not be easy, as I am sure Mr. Helms is bound to discover, if he has not already.

It was clear that in the case of some safety problems, he has not been informed adequately as to what has gone on in the previous administrations. And that is not meant in any way to discredit him. We have talked for many years from this chair about the faceless bureaucrats who never have to account for the failure of many worthwhile safety improvements to move from the research arena to the world of implementation. We discussed some of those issues yesterday, and we intend to reach back into earlier investigative hearings to find out what has happened with so many of the proposed improvements which have been touted as building blocks in improving occupant safety in survivable accidents.

This morning we are going to discuss two of the areas mentioned by FAA Administrator Helms yesterday, namely the new technical standard order related to water survival, and the new technical standard for crew member protective breathing equipment.

It has been several years since the subcommittee last inquired into the matter of water survival. I believe it was back in 1977 when we held the hearings on passenger briefing that this issue was last addressed. Those of you who were present during those hearings may recall the demonstration by some members of this subcommittee on the correct procedures to follow when donning lifejackets, following a short briefing by two witnesses well experienced in training crew members on these matters. One of our witnesses today is an expert in water survival training and another on the subject of hypothermia. I might add for those of you who were not present at that time the outcome of that briefing to committee members who were then given the opportunity to put on a lifejacket was that it could have run very well on "Saturday Night Live" or "Hee Haw". Most of the jackets were wrapped around people's backsides, heads, and I think maybe one member finally got a jacket on.

Anyway, we are also pleased to have with us this morning a gentleman who recently retired from the Federal Aviation Administration and who has conducted research on both flotation devices and protective breathing equipment while at the FAA's Civil Aeromedical Institute in Oklahoma City.

Before I introduce this distinguished panel, I would like to inquire if the ranking minority member, Guy Molinari of New York, has any opening remarks that he would like to make.

Mr. MOLINARI. No, Mr. Chairman, I have no opening statement.

Mr. LEVITAS. Thank you.

That being the case, the witnesses today are Mr. Wayne E. Williams, Director of the Institute for Survival Technology; Commander Alan Steinman, U.S. Coast Guard; and Mr. Don de Steiguer, Oklahoma City, OK.

Gentlemen, we welcome you. If you would each raise your right hand.

[Witnesses sworn.]

Mr. LEVITAS. Thank you very much, gentlemen.

We are looking forward to your testimony and it is, of course, extremely timely in light of the oversight which our subcommittee is now engaged in. Each of you are experts in your respective areas and I know your testimony will be of great benefit to the committee today.

So why do we not begin. Unless you have decided on an order that you prefer, we can begin with Mr. Williams, and if you will proceed as you so desire.

TESTIMONY OF WAYNE E. WILLIAMS, PRESIDENT, NATIONAL TRANSPORTATION SAFETY ASSOCIATION, AND DIRECTOR, INSTITUTE FOR SURVIVAL TECHNOLOGY, NOVA UNIVERSITY

Mr. WILLIAMS. Thank you. I appreciate the opportunity.

I am here to explain a difficult thing. It is a tragedy that we have not quite had yet. So it is very difficult to address it in concrete terms. But we feel the tragedy in the overwater area is absolutely inevitable, considering the Federal Aviation Administration's policies on airline overwater operations.

In addition, I would like to discuss one aspect of the fire smoke situation.

As background, in 1979, I joined airline pilot, flight attendant, and consumer organizations in protesting FAA policies on equipping aircraft for overwater operations. Beginning in 1977, that agency began allowing airlines to remove liferafts from aircraft operating out to considerable distances from land, over three times the long-established regulatory 50 miles. The first exemption to that policy was granted to Braniff in 1977. Actually, Braniff intended to prove that it would improve the safety by removing liferafts because it made the aircraft lighter, and then went on to add they would be able to carry six passengers and more cargo.

In any event, we felt that was a very negative move and exactly the opposite from that required. What was required was overall modernization of the equipment to address the problems we had. Then the FAA came back to me, as they had to the other organization, and told me that we should not worry, jet engines are more reliable than piston prop type, and they told us there had never been a planned ditching of a U.S. aircraft. All that was true. Actually an FAA spokesperson said after that that more people drown in bathtubs than airline water accidents. One of the problems is that we have a lot of very large bathtubs around the country offshore that will accommodate a lot of people very quickly.

The FAA regulations governing overwater equipment and the training of crews to use equipment have changed very little since the 1930s when the DC-3 was a typical kind of aircraft. Back then, rules were established which required lifevests and liferafts when operating more than 50 nautical miles from a shoreline, with flotation cushions being authorized for use out to that distance. In that era, the thirties, forties, and fifties, water emergencies were slowly developing things, where you would lose an engine—like the movie, "The High and Mighty," you got all the passengers in liferafts and vests and you had lots of time to do all these things, and if everything went wrong, we only lost 30 people.

But while the regulations and equipment have changed very little in almost 50 years, many other things have.

For one, the last planned ditching occurred in the Atlantic in 1962, a four-engine prop airline. Yet, today, airline crews are still being primarily trained to respond to a planned ditching scenario. That is a major problem. We have had almost 50 airline jet aircraft go into the water worldwide. The most distance from land was 30 miles.

The whole nature of accidents has changed. We know they are going to happen during approach-departure, and we know the occupants of the aircraft will have no time for preparation before the airplane is in the water.

We know that jet engines have been more reliable, but we found out very recently that they do not operate without fuel and not well without O rings installed.

Another factor is that pilots faced with many, many kinds of emergencies would much prefer to put the airplane down on a relatively flat surface of water than in the middle of houses, high rises or rough terrain. Just this year, we had a very close one. In southern Utah, we could have had a DC-9-80 in a very cold lake. Air Canada was considering landing on Lake Winnipeg. The potential is always there.

Compounding the problem is that the majority of all arrival-departures are over water. You have various estimates. We hear it is over 70 percent. There are 215 airports in the United States which have significant bodies of water around them.

So, several thousand times a day we have large numbers of aircraft arriving, departing over a considerable expanse of water.

And, finally, in this list of problems is that one accident today can involve not 30 persons but suddenly involve 200 or 300 hundred, very quickly.

We are addressing what is to us very obvious potential in some funny ways. First of all, only 25 percent of the scheduled airline aircraft have lifevests and liferafts aboard. The other 75 percent have none. The lifevests we are using are 1935, 1936 design, originally intended for military application, where people put the things on and got in the airplanes and went and flew over water.

I have five different variations here. I would be happy to show them to you in a moment. But these five variations—you see, one of the problems is that passengers think they have *a* vest. They do not have *a* vest. They have five different kinds of vests with which they would have to contend in a hell of a hurry. Most of the currently approved FAA lifevests have a very low level of buoyancy. Compounding the problem several times is the fact that even if you get them on and go into the water and have any wave action, you are very likely to drown and you are almost certain to drown if you go unconscious wearing a standard lifevest.

A doctor and his wife ditched over the Bahamas in February this year. After 5 hours in the water wearing one of these lifevests, properly inflated and attached to the body, the wife did drown.

We have done tests to show that even in light water conditions, the vests form a V which lets the water flood the mouth and the nose.

The liferafts we are carrying are too heavy, too awkwardly stowed. We are not getting them out of the airplane. The slide/rafts we have are a much better solution. Many of the aircraft—75 percent of the fleet are equipped with something called a flotation cushion. I have one of these here for you. You cannot appreciate this in this room. It has to be appreciated in the water. The typical aircraft card will show a picture of a person holding this to their chest floating on the water with the water line up to your shoulders. That is very misleading. You can float this way. Once you start weakening, you rotate flat on your back. You have a water line forward of your ears and every wave washes over your face. This is the only flotation device on a majority of the aircraft today.

I want to repeat that these devices are in use today out to 50 nautical miles from land as the only flotation device for large numbers of people. The Coast Guard have their own version of a flotation cushion. I want to tell you what the Coast Guard said about this. They say flotation cushions are not suitable for nonswimmers or children, should never be used when you can encounter hypothermia, should only be used where very rapid rescue is probable. We are going to see that not all those conditions apply to airline accidents.

The major problem of the flotation cushion, beyond the floating attitude and the inability—if you are a parent and have your child beside you and must use these flotation cushions, you will just have a great challenge in doing something with your child that would tend to save his life.

Beyond that, the fact is in cooler, colder, water you are not going to hold on to these cushions very long. One of the first manifestations of hypothermia is you cannot use your hands. Each of these flotation cushions requires use of your hands.

Last year, the Airline Pilots Association asked me to present a paper at an FAA seminar on water accidents. To prepare for it, I set up hypothetical examples of four examples around the country: 5 miles offshore at Fort Lauderdale, Boston, Portland, OR, and San Diego. I went to hypothermia researchers and experts, such as Dr. Steinman, who is seated next to me, and asked what would happen to people as of the accident date, which was March 10, 1982. Then I went to the Coast Guard, saw offices in each region, and asked them how they would respond to the accident. And I want to tell you what would have happened in Portland, midnight, March 10, 1982.

The sea temperature was 48° F. We estimated that within 5 minutes of entry into that water with flotation cushions, we would lose all nonswimmers, all children, all handicapped and most elderly. We further estimated that within 15 to 20 minutes, young healthy adults would have great difficulty holding on to the flotation cushions. Within 1 hour, we would have loss of mentation, mental faculties, and general loss of life about 1 hour and 30 minutes.

The Coast Guard was very cooperative. The captain in charge of that office wrote me a letter and gave me the scenario. He prefaced his scenario by telling me that I had happened to pick the absolute best location in the entire Northwest coast in terms of Coast Guard response. Here is what happened.

Twenty minutes after notification, the Coast Guard helicopter arrived on the scene. I remind you by that time we have lost those first categories and we are no longer holding on to flotation devices. That helicopter was not picking people up. He is doing survivor location and boat direction. He is having great difficulty because we have 200 persons spreading out over the water at night. The first rescue would have occurred in 1 hour after the accident was made known to the Coast Guard. They would rescue a body. The Coast Guard captain told me that what they would really expect to find in the real world is to find a lot of bodies on shore the next morning.

I want to read you an excerpt from a National Transportation Safety Board report on the World Airways accident at Boston last year because it sort of stresses the problem.

> Had the airplane plunged into deeper water farther from the shore, the two crash boats operated by the Airport Fire Department would have been launched. However, it is not likely that the boats could have reached the scene in time to provide assistance for rapid evacuation of the airplane. Therefore, the immediate survival of the occupants would have depended on the equipment carried aboard the airplane, primarily the underseat life vests and cabin exit slide/rafts.

We have to ask the question and appreciate what would happen to those aboard airplanes that have no equipment whatsoever. You must appreciate how long people would hold on to flotation cushions in water, 30° temperature, and even if the people have standard vests in that situation, we are going to have problems. They are not going to get them on before the airplane sinks. So we are depending on too many miracles, and we do get them occasionally.

The real situation is that the FAA is effectively exempting the airlines from having adequate protection within the exact zone where every airline jet accident has ever occurred. I told you all of them have happened within 30 miles, and we do not have any effective protection within 50 miles.

In early 1983, as the chairman mentioned, the FAA did issue a new vest standard. It could have been issued 7 years ago. All the information was there. The standard is a tacit acknowledgment that all of the prior vests are inadequate because the new standard requires a minimum of 35 pounds buoyancy as opposed to 23 in previous vests, and it requires donning by persons within 15 seconds. Those standards would not exist today unless the Air Line Pilots Association had put in a petition in December 1980, and unless there had been a lot of media focused on this whole area.

When the FAA denied the ALPA's petition 2 years later, last year, it noted, and appeared to be surprised, that there was broad public support for action in the overwater area. We were not surprised. The public has seen a "Quincy" show, giving a very realistic picture of an airline accident and perceived we were talking about a number of major things. There has been a lot of print media and there is going to be a lot more.

The FAA, as they denied the ALPA petition, also committed to do what they call a comprehensive review of the entire overwater situation. They acknowledged that there might be problems. They picked up a new generic term for flotation equipment, called a flotation platform, which we have been popularizing as an intermediate thing that would serve to get bodies out of the water until someone could come along and help you. They committed to complete the study by the end of 1983. I have been in touch with the people working on that study. It will not be completed by the end of 1983. They have confirmed that we cannot don vests. But we have not really learned anything new. We have the new standards, but we do not have new vests. We need new vests. If we let things go as they are, the old vests may be manufactured until a date in 1985. After that, the upgraded types will be phased in. But life vests, you see, as used by the airlines have a 10- to 12-year life span, perhaps more, service life. So if we just let the FAA take its time and do its thing, we are looking at the year 2000 before we have adequate life vests on 25 percent of the fleet, instead of the entire fleet. We are very likely to need a modern life vest before that. If we have one at our seat, positioned so we can locate it quickly and don it easily, on the way out of the airplane, if we have to, or in the water, if we have to, and if the design of the vest holds our unconscious faces clear of the water, we have a pretty good probability of survival even in very, very cold water because your body temperature can be vastly depressed and you can still survive.

The important thing is not to drown. That type of life vest should be installed at every seat as soon as possible.

Senator DeConcini has submitted a bill, S. 2011, that would require installation of the new TSO-C130 life vest on all aircraft by the end of 1986. Even if we do that, that is four more winters, and while we worry about this all year round, we start worrying more between October and March.

I hope I have made the situation clear enough to interest you and to generate support for that legislation in the House. We have no House sponsor currently and, of course, we cannot move and complete it without one. I really do not believe that we have to wait until we kill 200 or 300 people in this accident and then have all of the recrimination for such an obvious need. I think the need is too obvious. Drowning is too obvious.

I want to briefly address one aspect of the fire-smoke situation. That will not take me long, but before I do, I would like to ask the committee if you have any questions on the overwater equipment or if you would like to see the life vests.

Mr. LEVITAS. Mr. Williams, we will get into some questions very shortly, but I think it would be helpful if you would just show us the types of flotation equipment and life vests you have there.

Mr. WILLIAMS. I mentioned the flotation cushion. One of the ironies is that we have a life vest here built in England. It is a single-chamber, nonreversible vest, 35 pounds buoyancy. It is FAA-approved with respect to the same TSO and this single-chamber life vest outperforms every FAA life vest in use today. The primary benefit is that it has 35 pounds, which gets your face much clearer and as it inflates, it creates a bulge in front of your face which creates a wave-breaker to prevent the water from coming into your face.

Mr. MOLINARI. What is the estimate of that cost?

Mr. WILLIAMS. Under $30.

Mr. LEVITAS. How do you put that on?

Mr. WILLIAMS. You put your head through. I do not like this. This tying around the waist is ridiculous.

This is one chamber and you give this a sharp pull and you get it inflated. I had this in a wave tank in June. This was clearly superior to all these life vests. It is lighter and costs less and it could be a heck of an alternative to the flotation cushion.

This is a type of a life vest that was on the Eastern near ditching. There was a lot of confusion there. To successfully don this requires several steps. Do you want me to go through this?

Mr. LEVITAS. As a matter of fact, is that type of equipment in use today in DC-9's, or 727's in this country?

Mr. WILLIAMS. The use is very widespread. What you find within fleets, within airlines, sometimes one little fleet will have one type and another will have another type. This is in service generally.

Mr. LEVITAS. One of the things I have noticed, Mr. Williams, is when they demonstrate the use of the life vest on an aircraft, the flight attendant is standing up in an aisle all by herself or himself. If you have got an aircraft full of people, and you had to don your lifejacket, it would not be the same circumstance that she is operating or he is operating in.

Can you do it sitting down at your seat?

Mr. WILLIAMS. Yes, you can. But you have been shown doing it standing up and that is a problem.

Along that line, I wrote a major airline this spring. I had watched their vest demonstration and it was not consistent with the card and I got with the flight attendant in flight and the outcome of the conversation was she had two distinct different types of lifevests, neither of which we had been shown to use. I reported this to the flight attendant. Three months later I rode the same airline and saw the same thing. I wrote the president of the airline. He wrote me back acknowledging the problem, that there was a variety of lifevests on their fleet and that they were cleaning up their act, changing the card and getting new vests.

I rode the same airline last night, coming up here. They adopted this type of vest, but in the demonstration, the flight attendant did not show the one crucial step that many of the passengers on the Eastern flight did not accomplish, which is pulling down on this cord. I talked to the flight attendant, a very pleasant young lady. I asked her to feed this into the company.

They are not taking the trouble to reconfigure the vest. It can be a very crucial mistake.

Mr. LEVITAS. How do you do that?

Mr. WILLIAMS. Something like this. Arms go through. Here is what they did not show us to do. If you do not do that, the vest will inflate and go right over your head.

Mr. LEVITAS. If you were in the water—is that one of those that creates a——

Mr. WILLIAMS. It forms a "V" that forms a trough. The doctor's wife aspirated seawater, vomited, actually drowned in her own vomit, which eventually filled that trough. The doctor is very upset.

This one is a particular nightmare. You unpack the vest. It is like this. You have to figure out what I am doing here.

Mr. LEVITAS. Do you sit down and do that?

Mr. WILLIAMS. You need your arms. You have to hold this out of the way and then over and then pull down here and then finally adjust over the vest. All of the vests do have one thing in common, the red handles or blowing into the tubes.

Would you like me to demonstrate all of these?

Mr. LEVITAS. Yes.

Mr. WILLIAMS. This one you see a ring at the bottom. At the end of the strap you have hooks. You have to put the vest on. Presumably you have sat and read the instructions because once you have put it on, the instructions are down my back. I put that panel down my back. I find the end of these strings, bring them around, find this little loop, connect these and then adjust.

A frequent problem, I do a lot of—I do a lot of demonstration and speeches and a frequent problem is the passenger will do this, connect the two loops, which leaves the vest like that.

Now, this is an interesting variant of the one I just showed you, but it is enough different to throw you. On the bottom we have snaps on the end and on this end we have rings. Again, it is a matter of doing this. One of the Eastern passengers characterized these things as octopi.

Then you do this and adjust. What I am showing you gentlemen is just adult donning. For every method of adult donning I have shown you, there is another requirement for small children.

Mr. LEVITAS. Put that back on your head again.

Mr. WILLIAMS. Now on this one you reach around and snap these two through another one.

Mr. LEVITAS. What is that item up near your shoulder? Is that a light?

Mr. WILLIAMS. This is called a locator light. It is for accident scene location. It has nothing to do with rescue. When the doctor and his wife were in the water out there, they had Coast Guard helicopters over them at 100 feet. They never saw them.

Finally, I saved the best for last. I am not that happy with this one, but some airlines are using this one. As you can see, this one has an American logo. It has 35 pounds buoyancy. It has something else. It has a single waist strap. You have what amounts to a seat buckle-like connection. You have one connection and one adjustment. I still do not like the V, but I am floating higher out of the water. I have a much greater chance of getting this on.

I have people in the water several times a week, random people, yachtsmen, pilots, airline crews. I can assure you that they put the vests on in my program in the water blindfolded, packaged. Because that is the nearest thing I can do for them that relates to the airline accident. They all get it done, but you can hear 15-year flight attendants saying I would have been drowned by now.

That is the last. When we tried to get this bill going, Senator DeConcini agreed. We originally wanted standardization, because this begs for standardization. In the case of an accident, passengers should not have to figure out more than one thing and if they see one thing repetitively, the chances for success go sky-high.

We will probably have to have a TSO-C130 life vest, which should, by the 15-second donning requirement, give us a quantum improvement.

Mr. LEVITAS. Before we hear from you on the subject of fire and smoke, I just have one other question—I do have a number of other questions, as do members of the panel, but are you telling us that this new TSO will not result in standardization and we are likely to have a similar variety of vests?

Mr. WILLIAMS. Yes, sir. When a lot of us commented on the TSO, several of us proposed standardization and the FAA came back to all of us and said, "hey, we do not do that." We set standards and everything that meets the standard is acceptable.

What we have here, and what we are facing is sort of like a group of blind men examining the elephant. One feels it and says this and one thinks it looks like this and the others differ. Again you have variety.

Mr. LEVITAS. We will get to questions. If you want to make your comments on smoke and fire.

Mr. WILLIAMS. This is a flashlight that is installed on 120 airlines right now. I conceived this in 1975, took it through a prototype stage. My intent was to do a couple of things. I wanted to provide a positively available flashlight to flight attendants at their positions and I wanted to do something else. I wanted to provide a high intensity light that would be useful in smoke evacuation because I had packed some at FAA CAMI which indicated that high intensity would create, while they might not penetrate, they could create a contrast that could be perceived on the way out.

So as I was working on this thing, I envisioned that flight attendants would take it out of here, and it lights automatically and then would hold it low and direct passengers to come towards the light.

I left the company where I started this in 1976. It was adopted by another company and successfully completed. They did a beautiful job in finishing it. By the time they had the finished product, the FAA had two regulations out. One required that a flashlight bracket be installed at each flight attendant station. The other regulation said each flight attendant must have a flashlight. There was no requirement the flashlight bracket had to hold the flashlight or that it be installed.

So here this thing was and it was a good way to meet the new requirements. So it was sold in that context.

The idea of use in smoke somehow got lost and I was no longer connected with it and did not know what was going on really.

After the Air Canada fire, I became vitally interested again. I knew what I had intended with the light. I knew it was on the fleet. Here we have a cabin full of smoke. People are getting lost. That is why I developed it. It was on the Air Canada airplane at each end. As far as I have been able to determine, they were not used. So after the fire, I began talking to flight attendants and the unions and what I found out was nobody had ever been told that these things might be useful in smoke evacuations. That is true today. After I talked to flight attendants and determined the status of the situation, I went to FAA offices, two of them. I sat down with the people and explained the situation. I said, we have something that is useful right now, it is there. Let us get word out to the users. I got polite attention and apparent interest, but I saw no movement. So after about a month-and-a-half, fairly recently, I wrote Mr. Helms a letter. I asked for his personal assistance in getting word out to the potential users of these lights, because I think of accidents all the time. I am not sure how many of us think of accidents all the time. But there are a lot of people in the FAA who do not, and it is very hard to get a sense of urgency there. But I feel a sense of urgency about this thing, because we could have a cabin full of smoke right now and a useful aid that the flight attendants do not know how to use.

Mr. Helms had someone write me back and tell me that they would pass the word on that possible use of the flashlight through principal operation of the inspectors. How effective that will be, I have no idea. But I am absolutely certain that somebody should be doing something to alert the flight attendants to the use. I cannot do it, although I do it on the airplanes I fly on.

I have only addressed a couple of the problems here. As you all know better than I, there are many. But I think even a larger problem than the two I have described is that nobody appears to be minding the safety store. I found a multiplicity of lifevests on one airline. I had to go at it twice to get it corrected. I wrote another major airline recently. We were briefed on the airplane, which was a DC-9-31. The flight attendant pretakoff briefing told us that all exits were equipped with inflatable stairs except the aft exit. The aft exit is a tail cone exit and had a slide and I knew that because I did the engineering that put the slide in the cone. I looked at the passenger card. It tells you how to get back into there and deploy the tail cone and here the flight attendant is telling us that is not an exit. I called her over, talked to her a little bit. She argued with me. Until I told her I had done the engineering on the installation.

She agreed to report it. Four months later I rode that airline again. I got the same briefing. I was again told there was no slide at that exit. I wrote the president of the airline. I again got a letter that acknowledged, yes, this was wrong, and they are straightening it out, but these little things can be suddenly very important in accidents. That tail cone on a DC-9 can be the only way out, and passengers should be told that it is a way out. Somebody should be looking for these things like duplicate vests and improper demonstrations. I do not fly that much, but I see a lot of things wrong and I am wondering who else is looking.

I suggest that that needs attention.

I thank you very much.

Mr. LEVITAS. Thank you.

Commander Steinman, perhaps you could give the subcommittee a brief description of your background, your training, experience at the Coast Guard, and what your present assignment is.

TESTIMONY OF COMDR. ALAN STEINMAN, U.S. COAST GUARD, WASHINGTON, DC

Commander STEINMAN. I am presently a flight surgeon in the Coast Guard, approximately 12 years of experience. My present assignment is medical adviser to the Chief of Search and Rescue.

For 4 years prior to that I was Chief of Special Medical Operations and before that, flight surgeon in the field. I have extensive experience in hypothermia and survival. I have done a number of papers, research, served as an adviser to the American Red Cross, the International Red Cross, the Navy and other agencies on hypothermia, currently working primarily in matters of cold water survival, life survival systems aimed at Coast Guard rescue personnel.

Mr. LEVITAS. I understand that you have expertise in the whole subject area of hypothermia. It would be very helpful for the record, as well as for the enlightenment of the members of the committee, if you could give us a thumbnail, bridge sketch or course of instruction in what is hypothermia and how do you deal with it, if you do?

Commander STEINMAN. Be happy to.

In the context of an aircraft mishap, I think we should not just think of hypothermia, but think of the whole problem of what the passengers are going to go through if they have to survive this mishap and, of course, the first thing they have to survive is the impact and ditching and exiting, what we call egress in the military. You have to get out of the aircraft in order to survive at all, and the first problem is avoiding injury, surviving the impact. Getting out is complicated by fire and smoke in the cabin, which is less likely in an aircraft accident at sea, but could still happen.

Once you get out of the aircraft, you are now faced with the problem of sea survival and, as Mr. Williams has pointed out, your initial problem in surviving is avoiding drowning. That may seem like an obvious problem, but it is a fairly complicated problem. Basically avoiding drowning is keeping your nose and mouth above the water.

There are a number of factors involved that are not so obvious that perhaps we should discuss a bit. One is the ability of the survivor to swim, and by swimming I do not mean doing a breast stroke or the American crawl. I mean survival swimming and that is doing whatever is necessary to keep your nose and mouth out of the water. It is not easy. We have people who are trained who do not feel comfortable in any kind of sea state. Most people are not used to being in cold water or a situation where there are waves or wind or both or spray. This is a unique situation that is oftentimes difficult to cope with.

When I say the survivor has to be able to swim, what I mean is he has to cope with the sea state and if you have not been in that sea state, that adds immensely to the difficulties. If you have flotation available such as a life jacket, that is a nice step, but it is not the only step. Mr. Williams has given you one example of a person that drowned in a life vest. I can give you many more. A life vest will not solve your problems. Depending on the buoyancy and the distribution of the buoyancy around your body and the sea state and the wind, those all impact on your ability to survive.

We have found in doing wave tank tests ourselves in the Coast Guard on another matter altogether, and that is writing regulations for life jackets overall, that many life jackets do not behave very well in waves. A life jacket in which you float in a vertical posture has a tendency to have the survivor bob up and down in the waves, and we have very, very dramatic videotape footage in a wave tank at the David B. Taylor installation of waves passing over survivors' heads. I can personally attest to that. It is quite a dramatic thing to be wearing a life jacket and it gives you a nice free board and yet a 3-foot wave that is fairly steep and fast, the wave will pass over your head before the buoyancy takes you to the top.

Mr. MOLINARI. My understanding is that the Coast Guard is responsible for ensuring that pleasure craft are properly equipped with life vests and they customarily will stop some pleasure craft to check to see that they have an adequate number of vests for the number of passengers.

Commander STEINMAN. Yes.

Mr. MOLINARI. Do they also have the responsibility for design standards?

Commander STEINMAN. Yes; we do, sir.

Mr. MOLINARI. How does that differ? The standards that the Coast Guard has adopted for those who might be traveling in boats as opposed to the type of equipment that you are using?

Commander STEINMAN. What you are saying is would these life jackets meet vessel Coast Guard standards? Inflatables are a specific type of life jacket. Most of the Coast Guard regulations and requirements on life jackets on vessels require inherent buoyancy. They have to be buoyant without pulling a tag. These are not inherent buoyancy. I would have to go back and review the regulations. I am in the search and rescue section of the Coast Guard, rather than regulations; my recollection is that inflatables do not meet Coast Guard regulations as life jackets aboard boats.

Mr. MOLINARI. How about Coast Guard planes?

Commander STEINMAN. We wear inflatables on helicopters. Yet we have extensive training of our personnel on how to use them.

That is why we feel we can use those instead of having inherent buoyancy. That is a fairly bulky lifejacket.

Mr. MOLINARI. Is there a standard adopted by the Coast Guard for one type of inflatable?

Commander STEINMAN. No, sir, there is not.

Mr. MOLINARI. Do we have our own standard for inflatables?

Commander STEINMAN. No.

Mr. MOLINARI. Is there one type of vest used by the Coast Guard?

Commander Steinman. We have one standard vest in Coast Guard aviation.

Mr. MOLINARI. No matter what airborne vehicle you are on?

Commander STEINMAN. We consider standardization for our own aviation personnel an essential element.

Mr. MOLINARI. Thank you.

Please be seated.

Mr. SUNDQUIST. Could you describe which one of those it is near?

Commander STEINMAN. It is an——

Mr. WILLIAMS. I can speak to that.

The Coast Guard is using a version of a life preserver developed by the Air Force back in the fifties. It consists of bladders, two under each arm. Each of these bladders has more bouyancy than one of these life vests.

Commander STEINMAN. And we have survival equipment packed in the vest as well.

We were discussing the factors that affect survival. A person gets out of the aircraft and survives and into the water and has to cope with the sea state. The lifejacket itself is not necessarily going to save you. The more bouyancy the life jacket has, the better. The more able you are to keep your head afloat, the better. There was a study done in England that showed that a 45-degree angle to the sea state is best.

I mentioned the problem of bobbing in a vertical posture. The problem of being in a horizontal position is, there is no freeboard. Tests have shown that the 45-degree angle to the sea is ideal.

Swimming ability, coping with the sea, wearing a life jacket, and finally, being able to get out of the water into a life raft or flotation platform is extremely important. You have to get your body out of the water. So if survivors manage to stay alive after those first few minutes they are in the water, in other words, manage to avoid drowning, then you can think about and discuss the problem of hypothermia.

Hypothermia is a slow process, by and large. It is not going to be the initial killer in a maritime accident. The initial killer is almost always drowning from inability to stay afloat. You stay afloat and you are wet and cold. Now you have to think about hypothermia.

Let's give you a thumbnail sketch. I will try not to be very technical.

I define hypothermia as an abnormal lowering of your body's temperature. The body tries to keep itself at 98.6. The body defends itself best there and tries to keep that temperature. When the body gets too cold or hot, the chemical reactions that go on in the cells do not work very well, and the organs do not work well, and the organism does not work well after that. Cold water is the worst situation to be in in getting hypothermia, because you will lose your body heat to cold water 25 times faster than you will in air of the same temperature. I will define cold water as 70 degrees. You will get cold in 70-degree water very, very fast. You will get cold in 70-degree air, but it will take a long time. Seventy degree water temperature, which is rare in the waters around the United States—the geographic distribution of our shorelines, you do not find 70-degree water much at all, unless you go to Florida.

If you are immersed in cold water, you begin to lose heat. Your body recognizes that its skin is surrounded by cold water and tries to defend itself from losing heat to the water and will cut down the blood supply to the skin, particularly in your arms and legs, hands and feet. Unfortunately, those are areas that you need to protect in order to have manual dexterity. Your body compromises those immediately. Those areas get very cold very quickly. In fact, you will lose a lot of manual dexterity even before your body temperature goes down. If you cool off the skin and cool off the nerves that lead to the hands, there is loss of manual dexterity. You need manual dexterity to activate a life vest, flares, to use the muscles of your arms to climb out of the water or even to swim, and stay afloat. So that is a survival problem.

The next thing that happens as your body temperature declines is the brain senses that the temperature is going down. You begin to shiver. Shivering is nothing more than an involuntary reaction to generate more heat. Heat is a byproduct of muscle contraction. You try to generate more heat. We all shiver usually in cold air. Shivering there may be effective. Water is a good conductor of heat. If you are in the water and shivering, as much heat as you are producing, you immediately lose it to the water. So shivering will not protect you.

As your body cools down to 95 degrees, shivering is maximal. As you continue to cool, shivering begins to taper off because the muscles are too cold to shiver. Once you have lost your ability to shiver, you have lost your last physiological protection. Your rate of hypothermia increases dramatically, the rate of cooling increases dramatically.

You get into the low nineties, and your mental status is affected. Your judgment is affected. There are survivors who—deceased, who have been found on mountain tops with all their clothes off. See survivors hanging onto the side of a boat and suddenly decide they are going to swim away. They let go of the boat and swim away. This happens when the brain gets too cold. You lose your judgment and that affects your survival.

Finally, in the mideighties, you become unconscious. You lose consciousness if you do not have a—what we call a type 1 life jacket, which is one that will keep an unconscious person's face up. So we have people in a water survival situation that are unconscious and that is synonomous with death.

If you have a type 1 life jacket or one that keeps your face up or out of the water, you will continue to get cold and finally, at around 75 degrees, your heart stops beating. It just is too cold to continue. That is cardiac arrest, or death.

That is a thumbnail sketch of the steps the body goes through when it becomes hypothermic. In a sea survival situation there are a number of different factors that affect survival time. Obviously, the water temperature and the sea state. The colder the water, the faster you will cool off. In that regard, there is a lot of misunderstanding about cold water. Some people think that if you fall into ice water, you will die in a matter of minutes. That just is not true. In the Air Florida tragedy, there were survivors immersed in ice water for 20 or 30 minutes, and those survivors that survived the crash were still with it enough to assist. That is 30 minutes. You can live up to an hour or an hour and a half in ice water. So water temperature. The sea state we spoke of before. Ability to keep your face above the water. Availability of flotation, like a life jacket or platform. Any way you can get your body out of the water, you should. You are always better out of the water because of the high conductivity of water for your body's heat. Your body size and degree of fatness. Fat is an insulator. The one benefit of being fat is you survive longer in the cold. Obese people live longer in cold than skinny people. Women tend to have more body fat than men. So a woman of the same size as a man, same height and weight, will live longer than a man.

In essence—kids, kids have the highest rate of heat loss. Kids have the lowest survival rate. They have a relatively large surface area to lose heat, and a relatively small body weight, which is proportionate to the amount of heat they can lose. So your body size is important.

Your knowledge of how to survive is extremely important. There are things you can do if you find yourself in cold water to increase your survivability, just behavioral techniques. We teach a number of survival techniques to the general public. One is, if you have a life jacket, just to assume this position in the water, bring your knees up close to your chest. That protects your sides of your chest and the groin which are areas of rapid heat loss. You can almost double your survival time. You will feel very uncomfortable. If you do not have a life jacket, a lot of people are taught something called drownproofing. Drownproofing is not a good idea and I will tell you what it is and then tell you why it is not a good idea.

It is a technique that has been taught in the past for coping with surviving in water without a life jacket, and it is just a means of conserving your energy. Just assume a dead man's position and every 5 seconds, pick your head up and take a breath, and then put your head back in. It works very nicely in warm water. We all learned that in flight surgeon school or any military survival school. The problem is, when you put your face, head and neck in the water, you double your rate of heat loss. Do that in cold water, water colder than 70 degrees, you will cut your survival time in half.

So we have embarked on a campaign to teach the public not to drownproof in cold water. That is another survival technique that will impact on aircraft survivors' chances of living.

You should not swim in cold water. The more you swim and use your arms and legs, the more warm blood you have to take from inside your body and bring it out to your muscles and you lose that heat immediately to the water. Swimming increases your rate of heat loss tremendously. A study done showed excellent swimmers in cold water could only swim three quarters of a mile. So swimming is not a good idea. Unfortunately, when there are heavy seas or waves in the vicinity, you have to use some motion to keep the water out of your face, even if in a life jacket.

The availability of protective clothing, if you have a wet suit or a survival suit. Those are good ideas. But none exists on aircraft. So that is immaterial.

If you are injured, injuries obviously impact your ability to survive hypothermia, decreases your ability to cope with the seas, and finally, equally important to anything I have mentioned before, is your will to survive.

You will be amazed at the effect that your mind has on your body's ability to cope. We have seen this over and over again in mishaps in the military and the civilian world. People that are trained to survive in the hazardous conditions particularly in cold water, and know what to do and are confident in their abilities, survive longer than those that do not.

I will give you a quick anecdote on a fairly dramatic event. There was a cruise ship, the *Prinsemdam,* that burned off of Alaska. We rescued 500 people. Nobody was in the water. They had all gotten into lifeboats. Most of the people were elderly and were in lifeboats and had no protection from the elements. They were all cold. The lifeboat that had the Air Force paramedics who were extremely well-trained in survival and who taught their survivors in their own boat, kept their spirits up, they sang songs and they had a lot of confidence, those people were fine. One hundred yards away, identical set of people, they were cold, they were in trouble. So, there is an example of how your will to survive, the confidence in a situation impacts. Here is a group that was confident, kept their wits about them, did better than the control group that was cold.

Mr. **Molinari**. What do you mean, did better?

Commander **Steinman**. They were not as cold. They were not in as bad a shape as the others were.

Mr. **Molinari**. They all survived?

Commander **Steinman**. There were no deaths. But they were not as cold or in as bad shape.

Mr. **Levitas**. Thank you very much, Commander.

We will come back.

I know Dr. Rowland, a professional colleague of yours, will have some pertinent questions.

Now, Mr. de Steiguer, let me get your testimony into the record.

If you would, for the record, tell us a little bit about yourself, your background, your education, and employment experience, and I understand that you did work at CAMI a number of years.

I would like to know what you did there and what type of research you were assigned, particularly in the area of protective breathing devices, and what happened to the projects that you worked on.

TESTIMONY OF DON de STEIGUER, OF OKLAHOMA CITY, OK

Mr. **de Steiguer**. Surely.

Starting with my experience, I have 10 years of undergraduate and graduate study basically in the life and physical sciences. Following that, I worked at Aerojet General Corp. in the advanced research division defining the environmental conditions for space missions.

Following that, I was at the School of Aerospace Medicine in San Antonio in the environmental systems division defining environmental conditions for the orbiting laboratory.

Following 5 years at the School of Aerospace Medicine, I went to the Civil Aero-Medical Institute in the protection and survival laboratory. At the time of my resignation, I was the chief of the survival research unit. The responsibilities of that unit were basically in two areas: water survival and related equipment, and in oxygen and protective breathing devices.

I might start briefly with the water survival equipment, seeing that it would be continuous with what has been discussed, and then go into the protective breathing equipment thereafter, if that is acceptable.

Mr. LEVITAS. By the way, why did you retire or resign from CAMI?

Mr. DE STEIGUER. I resigned over a conflict with my immediate supervisor.

It was not related to research functions or activities of that type.

Mr. LEVITAS. When was that?

Mr. DE STEIGUER. One year ago.

I might touch first on the flotation cushion, since it has been criticized here as to what we were doing.

Before I do that, I want to make one thing very clear concerning the flotation cushion. It is not, and I wish to repeat, it is not an acceptable primary water survival device on an aircraft.

Several reasons for that have been discussed already. When you use a flotation cushion, you must, in order to keep yourself in a reasonable posture, swim with the device. This assumes that the individual does not have physical trauma which would prevent that. This assumes that a person is in an age bracket where they can swim and they are basically able to swim to some extent. If you simply hold the cushion to your chest, this rotates you into a backward position, your head back into the water, where you lose additional body heat, and it brings your nose and mouth just above the surface of the water where any surface activity breaks over your face.

For these reasons, I cannot accept flotation seat cushions as a primary device. The concept in its development was simply this. You have a cushion that you are going to sit on for comfort. As long as you are going to sit on a cushion, make it a flotation cushion, recognizing its limits and restricting to it a secondary or backup device to other types of equipment. Things do go wrong in accidents, and there will always be some who will not get a life preserver on and a flotation cushion, if available, might be of some help; in other words, better than nothing, but not much better.

I cannot accept that concept for a primary device.

The use of flotation cushions has caused some confusion as to what type of survival equipment is available. A lot of people have seen the instructions use the seat cushion as a flotation device. However, they are not on every aircraft. In the Pensacola water impact—the term ditching does not fit the FAA definition, so I will use the term water impact. Attempts were made to use seat cushions as flotation devices when they were not. So it tends to cause confusion as to what is available in the accident environment.

We were asked about 2½ years ago to test the adequacy of the TSO regarding flotation cushions, primarily dealing with the retained buoyancy of the flotation cushion after it has been in use in the aircraft, in other words, after it has been sat on many thousands of times, it has had coffee and drinks spilled on it, the covers have been cleaned and put back on, the normal aging processes. These need to be better documented in the TSO test procedure. We did proceed with that study which was underway at the time I left the FAA.

I am familiar with the results to date. They feel at CAMI that the existing TSO, with a few modifications, would probably be adequate for the flotation cushion, keeping in mind its limits, that it is not an acceptable primary device.

There is an additional problem with the TSO, no matter how well it might be redefined. The TSO contains a grandfather clause which allows previous models that have been approved by the FAA to continue in production. Rewarding the TSO to correct a deficient area does not necessarily mean that all the cushions will be so corrected.

The same clause is contained in many of the TSO's which allows prior items that have been approved at one time or another to continue in production. This negates upgrading.

I would also comment on individual life preservers, the type which you have seen demonstrated this morning. I agree 100 percent regarding the problems that have been pointed out. A study has just been completed at CAMI which was initiated prior to my resignation, in which aircraft-type life preservers were compared to donning time and the errors accumulated in donning, and were at the same time compared to two experimental-type life preservers. The results showed no significant difference in the various currently approved life preservers with respect to the amount of time required to do them. They were all very poor. The two experimental devices had no significant difference between them, but what is pertinent is that there was a very large difference in the donning time of the experimental devices versus the current style of aircraft life preserver.

This indicates that there are much better designs with respect to donning, that we can produce a life preserver that people understand, and can use. This does not mean that the problem is solved. As you correct one thing, something else usually needs to be addressed. But it is an indication that the potential is there, and I feel that continued work in that area is most appropriate, for I feel that given time and the resources, a much better design will be available.

Mr. LEVITAS. Well, Mr. Williams said that there has been know-how around for at least 7 years, as I understand it, on how to make a better life vest.

Mr. DE STEIGUER. Some of these things are not entirely new.

Mr. LEVITAS. Let me say, Mr. de Steiguer, and I say this because you have been so involved. I know I am speaking for myself, and I sense the same frustration on the part of other subcommittee members, that there is almost a "nutsy" unreality about what we are hearing. We are not talking about the most complex technology in the world. We are finding out that there are five different—or seven different varieties of lifevests which are available on commercial aircraft in this country. Where people are being given instructions, they are being given instructions about a lifejacket that is not even on the flight, or if it is, it is about one type rather than the other type. We are told that even the ones that are there, probably are dangerous because of their design.

I could go on and on. This is stupid. It is outrageous.

What is all this great bureaucratic focus on getting one type of usable lifevest that may save somebody's life if they understood how to put on that one, and somebody on the airplane must tell them how to use it?

There is almost an Alice in Wonderland sense about this and the Mad Hatter's teaparty.

Mr. MOLINARI. Will the gentleman yield?

Mr. LEVITAS. Be happy to.

Mr. MOLINARI. Yesterday, when we had FAA and Mr. Helms, you brought up the point that you had hoped at hearings such as these—you assumed there would be somebody and hoped there would be somebody in attendance that would be taking notes and reporting back accurately and would just like to ask if there is somebody in the room that is taking notes for FAA?

I would like to echo what the chairman is saying, because it deserves emphasis. As many years I have been present at hearings, and I have been present at every one since I became ranking, to sit here and listen to the testimony we have had today, I found it not only credible, but astounding, and I think as we get into the question, we will pursue that further, but it is unreal. It is absolutely unreal.

Mr. LEVITAS. It is just unreal.

You can take a seventh grade class and tell them this story and they would not believe it is their own Government and their own country's industry that is responsible for what we are hearing from you gentlemen today.

We will get back to you.

Mr. Rowland?

Mr. ROWLAND. Have we identified what the barrier is?

What is the barrier? Why is it so difficult apparently to institute some of these measures?

Mr. LEVITAS. I do not think we know fully, Dr. Rowland. There is that GAO report that might shed some light, but Mr. de Steiguer might shed some light on it.

Just take one example—did you—or anyone at CAMI, ever express your concerns about the problem with the flotation seat, for example, to the Office of Flight Standards?

Mr. DE STEIGUER. That has been expressed many times.

Mr. LEVITAS. Did you ever express to anyone the concern for modification of the TSO to FAA officials?

Mr. DE STEIGUER. Yes.

Mr. LEVITAS. And what happened?

Mr. DE STEIGUER. No response.

They continued with the existing policies.

Mr. ROWLAND. Do you have an idea as to why there was no response?

Mr. DE STEIGUER. I think the act presents the FAA, with two conflicting responsibilities, one, providing for safety, and the other promoting the industry—there are times when these can be in conflict, and I feel this is the underlying basis of the problem, and that at the present time, safety system is taking a backseat to the promotion of the industry.

Mr. ROWLAND. That is part of the function of the FAA, to promote industry?

Mr. DE STEIGUER. Yes, from my understanding, that is part of the act.

Mr. LEVITAS. Thank you, Dr. Rowland.

Mr. de Steiguer, if you would now move into the other subject matter, and then we want to start back around.

Mr. DE STEIGUER. Following the Boston accident in November 1973, in which the function of the protective breathing equipment was questioned, the FAA held two meetings with the industry, one on the west coast and one here in Washington, and agreed that a test program was needed. The problem being that there was no proof of performance requirement for equipment of this type.

I was charged with the responsibility to, one, develop a proper test procedure; and, second, test all equipment submitted to the FAA by the industry, and to complete that study within one year.

We completed the study in 9 months. We developed the test procedure. We received from the industry 137 different kinds of protective breathing equipment intended for use on the flight deck. This is the emergency equipment for the pilots, first officers, and flight engineers, those people flying the aircraft. Of the 137 items that we tested, only 22 passed the proposed acceptance criteria. This basically points out that we have a lot of junk on the flight deck in terms of protective breathing equipment. It does not function. Worse, it gives a false sense of security as to the equipment you have to use in an emergency.

In December 1975, the industry was briefed on this situation by the FAA in Oklahoma City. Two things came out of that. One, a request that we continue the study, working with the industry, to effect a solution to the problem.

Mr. MOLINARI. May I interrupt you?

I would like to get back so I make sure I understand your earlier testimony.

You indicated there was 157——

Mr. DE STEIGUER. 137.

Mr. MOLINARI. And what were these 137?

Mr. DE STEIGUER. Different types of protective breathing devices on board for use by crews on flight decks of aircraft.

Mr. MOLINARI. That were purportedly there to be used, taken off, tested, and only 22 found to be in working condition?

Mr. DE STEIGUER. That is correct.

As I indicated, we were requested to continue the study working with the industry to effect a solution to the problem. The other significant factor at that meeting, the FAA indicated that they would publish an NPRM in this area by February, 1976. We continued the study and we worked the problems out. We have a solution to the problem, a solution that is very cheap economically and that will not create a financial burden on the industry. It does not require complete new equipment. It does not require additional aircraft oxygen. You may replace the oxygen mask if you so desire or you may simply replace a component in the oxygen mask. The solution is very simple, and it simply is a method of providing a venting flow of clean gas through the goggles the individuals wear. All of the mask manufacturers have this equipment available. You may buy it or you may buy a retrofit kit and make the conversion.

The FAA finally published a TSO in which the testing procedure was spelled out. There is no requirement to date to correct the equipment on the aircraft. As I flew in yesterday from Oklahoma City, I could see on the flight deck equipment that would not function in a smoke-fume environment still there, and no requirement from the FAA, even at this date, that it be corrected.

[The following was received from Mr. de Steiguer:]

OKLAHOMA CITY, OK.

Mr. JOHN STRATTON,
Rayburn House Office Bldg.,
Washington, DC.

DEAR MR. STRATTON: If it is appropriate, I would like to add the following statement to my testimony, page 52 line 1242.

An example of indifference on the part of some elements within the FAA is the certification of the Boeing 757 and 767 series aircraft with protective breathing equipment that will not function. At the request of ALPA, CAMI tested these devices, demonstrating that they would not provide proper protection for the crew members. The FAA was apparently embarrassed when the results were released and consequently have forbidden CAMI to continue testing of protective breathing devices.

If this is not an appropriate addition, at least you should be aware of what is happening as it constitutes a "back-door" strangulation of an area of work that is appropriate. I do not believe the Administrator is aware of this—it is the policy of one under him.

Sincerely,

DON DE STEIGUER.

Mr. DE STEIGUER. Continuing that type of work, we began to look at equipment that would be suitable for flight attendants. At the present time, we have no requirement for such equipment unless there is an isolated compartment that is occupied in flight, such as a lower load galley. We were anticipating a future need when we continued this study with flight attendants' equipment. Quite frequently, they are the ones that have to fight the in-flight fires and to function in areas where the smoke concentration may be critical. Numerous aircraft have been certified with only two crew members and you cannot expect those people on the flight deck to handle the emergency situation, fly the aircraft, and be at the back of the aircraft figthing a fire.

I think we are asking too much.

The flight attendants, in all probability, are going to be the ones engaged in fighting fires.

At the present time there is no protective breathing equipment in the passenger cabin for them. We did study that type of equipment and such equipment is currently available. We know the equipment that works and the equipment that does not work. We felt we had identified and developed acceptable solutions for the crew equipment problems. The decision was made to look at equipment that might be available for use by passengers, which apparently could have helped in the recent Air Canada DC-9. We wanted a device for passengers that would operate simply by donning the device.

They would not have to take any decisive actions in relation to how the equipment functions.

I want to point out at this time that numerous ideas have been forwarded through the years by concerned individuals to attack this particular problem. Invariably, they involve decisions on the part of the passenger. An example of what we try to avoid in equipment we received a proposal for attaching a chemical filter to the existing oxygen mask. The passenger would then adjust a lever on the mask to the left or to the right, depending on whether it was a decompression or a smoke fume environment. What the gentleman did not realize is that passenger masks are usually nondirectional, so if you rotate the mask 180 degrees, what was left and right, now becomes right and left. If you rotated the mask 90 degrees, what is left or right now becomes up and down. These are the kinds of suggestions that will not result in practical solutions. There has been a number of this type of suggestions submitted to us through the years.

Our approach was to have a single device that would function for the passenger in a decompression situation, the same device working in a smoke-fume environment, and the same device providing some time for emergency evacuation, in other words, it should become portable, allowing the individual to evacuate the aircraft in a smoke-fume environment.

We not have a complete answer at the present time. We have made a very simple modification to the existing passenger oxygen mask that is an economical approach to a solution. The problem we have with it, the time for evacuation while wearing the device is not as long as we would like to see, but that does not negate the progress we have made.

We do need a slight increase in oxygen flow to the system which would require more oxygen either in a gaseous form aboard the aircraft or a different type of oxygen generator. And we still have a potential problem, which we have not addressed yet, passenger acceptability of the device. If they will not use it, or whether they have a problem using it is an area that needs to be tested.

At the time I left, those were a couple of the questions still hanging fire on the device.

Mr. MOLINARI. Why wouldn't they use it?

Mr. DE STEIGUER. The Air Canada DC-9 is a classic example, where a clean source of breathing gas in an environment that contains a good deal of carbon monoxide, hydrogen cyanide and other toxic gases might have helped. The device would also function for providing oxygen to the individual in the event of decompression so as to maintain the individual in a conscious state. In something like the Air Canada DC-9, had they been wearing the device, it would have given them some time, with a clean source of gas to breathe, while they evacuated the aircraft.

Mr. MOLINARI. Are you saying the equipment was there and the passengers opted not to use it or that the equipment that you are suggesting could have been installed?

Mr. DE STEIGUER. I am saying that the equipment we have been examining could possibly provide these three functions.

Mr. MOLINARI. I still do not understand why the passengers would reject a lifesaving piece of apparatus.

Mr. DE STEIGUER. The device requires some rebreathing of your prior breath, and as such carbon dioxide may become limiting. When I say passenger acceptability of the device, we know that we have physiological conditions that they can tolerate. But a number of people in the general public would not wear the device to its limits. You can wear it and get physiological protection, but it becomes stuffy and hot, and some may feel it does not work, and remove the device. When when you design a device that people will not wear to the fullest, then you have not answered the problem fully.

Mr. ROWLAND [presiding]. Mr. de Steiguer, are you familiar with a hood that is made by the Xenex Corp.?

Are you familiar with this?

It hooks right into the air flow. Are you familiar with that?

Mr. DE STEIGUER. I know Mr. Werjefelt was working on that at the time I left the FAA.

Mr. ROWLAND. He feels it is perfected enough to be used.

Are you familiar with it enough to make a comment about it?

Mr. DE STEIGUER. I have not seen his device.

I will say this. We included a hood device in our studies of passenger protective breathing devices. The hood device functions very well in giving protection from toxic fumes providing you put it on sufficiently soon. In the CAMI studies back in the early sixties, it was shown to be an evacuation device, again providing you put the device on free of toxic fumes.

In other words, you have to get the device on before the toxic fumes become critical. We included a hood in our study to see if we could get acceptable decompression protection with the device, and we could not.

Now, you get into the area of trade-off, or two sets of equipment. If the hood will not work for decompression, then we still must maintain the passenger oxygen system as is for decompression with a hood device being a separate piece of equipment. You can always raise the question of the logical sequence of events in an accident. If we have an inflight fire with a burn-through, and decompression while wearing a hood device, it would mean that you must remove that device and go to the passenger oxygen mask.

Mr. ROWLAND. Let me ask you to look at that folder and make any comments on it.

I understand this hood has several capacities, both for decompression and for protection from toxic gases.

Mr. DE STEIGUER. No, sir.

The device will not function in a decompression. It will provide protection in flight from toxic fumes and is of sufficient volume to provide you with some time for emergency evacuation. But for the device to function during a decompression, you must quickly increase the pressure of oxygen in the device, almost to 100 percent oxygen.

In a device of this type, the time required to accomplish that negates its use in a decompression, so that the device would not function in that mode. But it would function as a protective device for smoke and fumes as long as pressure in the aircraft cabin is maintained.

Mr. ROWLAND. Do you think it is possible to adapt that where you connect it to the oxygen supply?

Mr. DE STEIGUER. No, sir.

We considered that and we flooded the device with a large flow of oxygen for 2 minutes and we did not have a PO2 sufficient to maintain consciousness during a decompression.

Mr. ROWLAND. Is that because it is not airtight?

Mr. DE STEIGUER. No. It is because the large volume of the device and the time required to flush nitrogen from it. In other words, put a small cup here with blue water in it. I pour water in it from this pitcher. It takes a certain amount of time to flush the blueness out. You increase the volume of that cup, it takes longer, and more water to flush the contaminant out. This is the problem with the hood device during decompression. It will not function in that mode. That is the problem with the device.

It will function as a protective breathing device as long as the cabin pressure is maintained.

Mr. ROWLAND. I understand the concentration of oxygen in the ambient air normally is about 20 percent and this exists up to, what, 100,000 feet. The difference is a difference of pressure that is exerted?

Commander STEINMAN. Correct.

Mr. ROWLAND. The oxygen you get in a case of decompression is oxygen stored on board the plane?

Mr. DE STEIGUER. Correct.

Mr. MOLINARI. Are you finished with your testimony?

Mr. DE STEIGUER. Yes, sir, I think so.

Mr. ROWLAND. With reference to hypothermia, would any simple gear, for example, some type of headgear, since he is locked to a large extent through the head area, be of any benefit, or what about keeping clothing on rather than taking off any clothing, would that be of any benefit?

Commander STEINMAN. Both would be of benefit. Certainly keeping your clothing on would help. Something as simple as a woolen watch cap would go a long way, particularly if your head is out of the water, in reducing the rate of heat loss. But clothing provides rather significant protection against heat loss in the water, even light clothing. There have been some studies that have been done in rather calm water that showed that heavy woolen clothing, for example, of the type worn by a New England fisherman, they fall overboard, that heavy woolen clothing provides a good layer of insulation, as long as you do not flush a large amount of water through it by swimming.

Mr. ROWLAND. What do you have for protection in the Coast Guard?

Commander STEINMAN. In the Coast Guard aircraft we have to balance hypothermia in the event of a mishap over cold water, with the ability to fly aircraft. So you are trading off hypothermia protection with mission requirements. We have typically either wet suits or antiexposure coveralls made out of wet suit clothing, like a snowmobile suit, that our helicopter crews fly in when they fly over water under 70′. When you are flying, the suit is very uncomfortable. So we are trading off comfort with hypothermia protection. We are still grappling with that. But we do fly with hypothermia protective garments when we fly over cold water.

Mr. ROWLAND. Would any of this equipment that Mr. Williams demonstrated this morning be acceptable to the Coast Guard?

Commander STEINMAN. As an inflatable device; no, sir.

Our philosophy in survival gear for our crews is to keep it as simple as possible so as to make it sailor proof. Sailor proof means if somebody will misapply something or something will go wrong, it will. So you have to make it as simple as possible and it should be standardized. We try to make our vests standardized. But there is a difference between the commercial airline passenger and our crews, and it has to do with, first of all, training. Our crews train for survival. They know what they are going to do. They go into cold water. They go in with life vests and with wet suits and they know how their body will react. We cannot expect that from the commercial airline passenger, and the other difference is if you are not wearing it, you do not have it.

So we would not store a life jacket, for example, for a helicopter crew somewhere and expect the crew to go get it. So there is a difference between our air crew and a passenger.

Mr. MOLINARI. What I am hearing is that despite the fact that they are well-trained and they fly often, that you still insist that the life vests be simple.

Commander STEINMAN. Yes, indeed.

Mr. MOLINARI. You make a good point, that you cannot compare Coast Guardsmen to passengers of commercial airlines. For God's sake, if we are going to make them simple for the experts who are using them all the time and are trained, then, can we not expect the same application of common sense in commercial passengers?

Commander STEINMAN. I would agree. The simpler the better.

Mr. MOLINARI. What am I missing, then?

Where is the fault, gentlemen? Can somebody tell me that. I know we may be stepping on some toes, but I am listening to this testimony and we are coming from two opposite ends of the pole, and I am trying to bring the pieces together.

Mr. WILLIAMS. I may be able to help.

In the military area, I said earlier, that this basic life vest is a 1935 design. I wore it when I was a kid on carriers. I put that thing on for 4 years and went to fly over water with one of these same vests. It was a little better than these, but virtually the same. By 1947, we had a much better vest and as the years passed, we had still better vests. We operated in the context we knew we were going to lose people. We acknowledged that fact. The airlines do not acknowledge that fact. That is one thing. There was a mention awhile ago to what the barrier is. The barrier is something called cost-benefit.

I have an FAA internal memorandum with me that is a cost-benefit study in the over-water safety area. The FAA said in essence that there is no point in doing anything because based on historical losses, adding new life vests and rafts to the airlines not now equipped would only have the potential of saving 0.53 lives per year. So we are operating in the historical context.

I would like to relate two instances into the record that illustrate, really illustrate. One is a ship accident off the Canary Islands, a Greek vessel, a big vessel. Two hundred persons did not go into the rafts and boats but were wearing marine-type personal flotation devices. Rescue came in 3 hours. Of the 200 persons floating in the water in the devices, 113 were dead of drowning. Witnesses around them who watched them die said that wavelets, the seas were calm, were lapping at their mouths and noses. The vests did not quite do it. The water temperature was 64° F, and authorities around the world say we can expect 60 percent casualty losses among people whose faces are not supported out of the water in under 3 hours.

It is a little hard, again, to point to specific incidences. We have not had the number of losses we are known to have all at once, but in April, 1954, an old Boeing stratocruiser went into Puget Sound after takeoff from Seattle Airport. It was April, daylight, boats in the vicinity. Thirty-eight people aboard the aircraft. The airplane floated 15 minutes. Thirty-eight people exited using flotation cushions. Five of them drowned in under 15 minutes. Forty-two degree water.

Mr. MOLINARI. We hear the answer is cost-benefit. I think cost-benefit is necessarily something that has to be considered, although some people might not like the idea. But I am wondering, for example, in the case of the Coast Guard, how does the cost of your equipment differ from the cost of equipment being installed with commercial airlines?

If we are going to discuss a possible answer, is anybody prepared to give us some answers so we could see what the difference is?

Mr. ROWLAND. Would the gentleman yield before that question is answered?

I am interested in the cost-benefit statement that you made, too. Based on what you said, I assume, then, what will have to take place, we will have to have the loss of several hundred lives in order to make the cost-benefit ratio more appealing.

Mr. WILLIAMS. Yes.

We will obtain cost-benefit one of these days in one accident.

Commander STEINMAN. Our new inflatable lifejackets for Coast Guard helicopter crews will cost $200, but it is not a comparable lifejacket because we demand the material be fire retardant and it incorporates a lot of survival equipment and the way it is constructed is to military specifications which adds to the cost of it.

So $200 versus $30 makes it extremely expensive. I am not sure the same degree of quality, certainly with the survival equipment attached, needs to apply to the commercial application.

Mr. MOLINARI. How about the life expectancy of the equipment?

Commander STEINMAN. It is in the 5- to 10-year range.

Mr. WILLIAMS. The most likely cost for TSO-C130 vest in the quantities that would be required, about half a million, to equip the fleet, would be in the neighborhood of $30. You have something that—whether it is correct or not, is being used as long as 15 years. That is pushing it a little bit. But we take a different approach to cost-benefit. Our arithmetic comes out different. The FAA cites $40 million, $60 million cost. We say that this one device at one seat would serve many, many passengers and what it all comes down to is about 5 cents a ticket for acquisition and fuel and installation over the course of the lifevest life.

Mr. LEVITAS [Presiding]. I have a few questions, but before I do, Mr. Sundquist?

Mr. SUNDQUIST. My questions have all been answered.

Mr. LEVITAS. You talked about the over-water operations and 25 percent of the commercial carriers are—I am paraphrasing—are today equipped inadequately for this type of operation and 75 percent of the fleet is not equipped at all. And yet every time I come into Washington National Airport, I am flying over water. One way or the other.

As the events of last winter demonstrate, the Air Florida crash, you do not have to fly over the Atlantic Ocean to perish in a water accident, whether it is the Potomac River or Puget Sound or the Pacific Ocean. The problem is there.

My question is, shouldn't there be adequate provisions for flotation?—not only is the flotation cushion not adequate, based on what you have told the committee, Mr. de Steiguer—it could even create problems. I did not know that if you held it the way they told you to, you would float on your back. Somebody ought to tell us that.

What do you recommend we do?

Mr. WILLIAMS. I think from a safety standpoint, and it would ease the airlines' scheduling problems, we should have a suitable, easy-to-don lifevest that will keep your unconscious face out of the water at every seat. As you noted, the potential is not mid-ocean, it is Potomac River, Lake Winnipeg, Lake Powell. It is approaching LA. It is a lot of different places. I could cite accidents for days.

I want to mention one. In the 1950's, a DC-3 was approaching Allegheny County Airport. Twenty-eight persons. Ran out of fuel. This pilot looked around and the only flat space he could see was the Monongahela River. He landed. It floated. Twenty-eight persons, mostly male, healthy, young, military, got out on the wings. The airplane sank. They were 75 feet from shore. Twenty-eight struck out for shore. Ten died.

This is the kind of thing that says, water, water everywhere, and you need protection.

Mr. LEVITAS. If we are going to provide these personal flotation devices, they ought to be ones that are, based on what I have heard, standardized, so that the problem of learning how to put one on properly is not further complicated by misinformation or a whole variety of different systems.

I thought Mr. Williams' question brought out a very important point, that it would become immediately cost-effective if a 747 was down with a full load of passengers and because of the inadequacies of flotation devices, everybody drowned. Then we could justify it from a cost-benefit point of view.

The other part of it is also true. Had that accident, which is waiting to happen, occurred last week, we could have held this hearing in the Cannon caucus room and not had enough seats to accommodate everybody who wanted to come. But because we have not had it, or because Air Canada occurred a few months ago, nobody cares about this, nor will they, until the next accident happens, and that is the real tragedy of the reactive component of FAA, leaving aside its other problems about taking forever to do something about that situation when the technology is there, and they just dc not get around to doing it.

Mr. MOLINARI. I get the understanding that all of the branches of the service consult with CAMI from time to time.

Is that a fact, Mr. de Steiguer?

Mr. DE STEIGUER. It is not a formal or a set procedure. I have frequent contacts with various military forces.

Mr. MOLINARI. Is there an ongoing contact between them and CAMI with respect to new pieces of equipment, that they desire or you are developing?

Mr. DE STEIGUER. There is a good deal of cooperation in that area, yes.

Mr. MOLINARI. What puzzles me, as I learned today from the commander, based on their own experience, I guess, they have sought and developed superior equipment which is in use by them, and that equipment is not available for commercial aircraft. Now, when we ask why the first answer, we get the cost-benefit. I do not know, however, that that would be the correct answer in each and every case.

The thought that comes to my mind is do we have a situation here where the branches of the service are getting improvement in some of the equipment that would just as easily and just as inexpensively be made available to the commercial, and that it is not being done?

Do you know of any instances where that might be the case?

Mr. DE STEIGUER. Let me address your question in a broader scale. There is a program that was initiated in CAMI—slightly over 2 years ago. I defined various areas of that program before I left the FAA. In that program two of the items involved the testing of life preservers for use in the civil air fleet. The primary interest being ability to don the device.

As I indicated, we do see potential for drastic improvement in that area. We have an experimental vest that people understand how to put on. There are a good many new materials available in the last three or four years. I might mention Gortex fabric, thinsulate insulation. These are being examined for their potential in providing thermal protection in life preservers, not of the type you have seen here, but of the two experimental types that I have mentioned. These materials have been recently used by the sporting industry, not in water survival equipment particularly, but in hunting clothes where they are not in or immersed in water. We are looking at these materials in an attempt to provide some thermal protection in the experimental vests I mentioned, vests which the passenger finds easier to don.

This does not say what the end results will be, but the indications are that we have the potential to provide some thermal protection, and I feel for a large order of vests at a reasonable cost. We could not say at this time that this new type of vest should go on the fleet. We are far from that point. There are a number of additional problems. One area that we must keep in mind when we design new devices is sizing, or, the problem is not to have a great difference in sizes. A person should not have to reach under his seat to get a small, medium, or large vest. We want a universal device that will fit the 80-pound grandmother and the 359-pound linebacker. There are ways I feel of doing that and these ways are being examined in the experimental vest I mentioned.

This is still an ongoing effort to provide an automatic sizing device, but I feel this can be done.

Mr. MOLINARI. I am encouraged by that.

Let me suggest this. In talking about water survival, as we have this morning, I have learned several interesting points. The commander has pointed out that in terms of heat loss, that if you keep the head above water, you cut the heat loss in half.

Commander STEINMAN. Pretty close to it.

Mr. MOLINARI. So in the order of priority, if you are attempting to provide additional time to save lives of those that are in the water, the initial emphasis should be on trying to elevate the head by whatever system you are working on. There was reference made in two different places—first of all, Mr. Williams, of all of the pieces of equipment that you brought with you, the one that is far superior is the English model.

Do you have an idea of what the cost of that unit was?

Mr. WILLIAMS. Less than the $30 I cited for the others.

Mr. MOLINARI. How long has that been in manufacture?

Mr. WILLIAMS. It has been in use for foreign airlines for 10 years. The foreign airlines are standardized on 30—pounds buoyancy. The only ones that are not are the ones that buy U.S.-equipped airplanes.

Mr. MOLINARI. Is it your experience that foreign airlines would have a carrier—or a country would have a standardized——

Mr. WILLIAMS. I have that impression. I think you would find this type widespread on British airways, and perhaps Australian airlines, as well.

Mr. MOLINARI. Is it mandated, do you know, in England?

Mr. WILLIAMS. I am not sure of that.

The British are a seafaring race. They take this a little more seriously and they are ahead of us.

Mr. MOLINARI. You mentioned, too, about some English studies.

Commander STEINMAN. Yes, a study that looked at the position of the survivor with respect to the sea state, the waves, and what was advantageous and not advantageous, and they found the 45-degree angle.

Mr. MOLINARI. What are we being told, that England has a far superior set up when it comes to assessing life saving techniques?

Mr. WILLIAMS. It is more realistic, unless they are using U.S. equipment. Again, resulting partly from the studies Commander Steinman mentioned, there is an acknowledgement around the world that 35 pounds is the absolute minimum you want to keep that angle and to keep your face clear.

Mr. MOLINARI. The flotation devices you have, can somebody tell me what the relationship is between the weight of the person and the ability of that flotation device to carry the weight?

Mr. WILLIAMS. There is no direct relationship. You can look at a very fat person and they have less buoyancy than a moderate build. It is deceptive.

Commander STEINMAN. It would have to do with the shape, the lung volume, and amount of fat. You can have a 300-pound mass, a

250-pound obese individual, and a 250-pound shotputter who will have very little fat, a sinker, in the parlance, and there would be great difference.

Mr. MOLINARI. What about the relationship of head above water in that vest?

Can you tell me how successful they are in elevating the head?

Mr. WILLIAMS. The recent test we did with Cable News Network, we had all of these in a wave tank out at one of these amusement parks, 4-foot waves, not terribly rough. The person wearing this was high and dry and not having trouble with waves breaking. With all of the FAA ones, especially the 23-pound vests, you are riding much lower, and you are getting the bobbing, and you have this trough feeding the water right into your mouth and nose.

Mr. MOLINARI. I just want to ask the Commander, we talked about before when you were testifying about the equipment, that you would have on both—I assume that while they may be superior for those that might be floating in the water, the reason you cannot have them in the plane is because of their bulk.

Commander STEINMAN. Primarily. With inherent buoyancy you have bulk. These are more compact because you can rely on CO_2.

Mr. MOLINARI. In Mr. Williams' testimony, he is talking about FAA granting waivers and the consequence of those waivers was to provide additional passengers. I do not recall the number. Was it six?

Mr. WILLIAMS. Braniff said if they moved 1,000 pounds of life raft, they could add six passengers or commensurate cargo. It is really a fuel savings. The weight decreases directly in relationship to the fuel consumption.

Mr. MOLINARI. Assuming there was enough space, if we were to take one of the units, I do not know whether you are familiar or not with the boating equipment—would you be familiar with that?

Commander STEINMAN. I am somewhat familiar with it.

There are a variety of flotation devices that are acceptable depending on the size of the boat and the distance from the shore.

If the committee is interested, we would certainly provide you with those regulations.

Mr. MOLINARI. I have seen some of them and they do not seem to be very big or bulky. That is why I am trying to determine the question of weight and fuel, or the question of space required, and that is something I am having difficulty understanding.

Commander STEINMAN. The different types of vests, and they are rated on the amount of buoyancy and the ability to keep your head out of the water if you are unconscious—the bulkiest one, the kapok vest, is very bulky and very buoyant.

Mr. MOLINARI. It does not have much weight, though.

Commander STEINMAN. No, but it is not compressible. You can go to a vest-type lifevest, which is smaller in bulk, a little less in weight, but provides far less buoyancy. It will not keep your face out of the water. Then there are flotation devices that you can throw to a survivor and there are five or six different types.

Mr. MOLINARI. Is there any that would be adaptable for plane use that are used successfully in boats?

Mr. WILLIAMS. I work with both marine and aviation vests, and one of the basic concerns of surviving in a floating cabin or aircraft interior is you do not want inherent buoyancy if this thing is flooding. You move up toward the ceiling. That is the same problem with the flotation cushion. You would face a choice of letting go to get out of the aircraft.

Mr. SUNDQUIST. Are the flight attendants explaining that, that you are not supposed to inflate it until after you leave the plane?

Mr. WILLIAMS. Generally they cover it.

We saw in the Eastern event that several passengers did inflate it.

Commander STEINMAN. An inflatable vest is the most ideal. It gives the biggest bang for the buck.

Mr. MOLINARI. Are there inflatable vests that are used on both, that are certified and used?

Mr. WILLIAMS. By several foreign governments, not by the Coast Guard.

Commander STEINMAN. This I am not totally conversant with. I do not believe it meets our requirement on a vessel.

Mr. MOLINARI. I have one or two questions about your organization, Mr. Williams, the National Transportation Safety Association.

What is its relationship with the goals which you obviously try to provide to passengers that are traveling?

Mr. WILLIAMS. The organization was really formed out of desperation. As of 1979, there were a lot of us working in this area independently, usually going the same way and being brushed aside individually pretty quickly. So the organization was formed to coordinate the efforts of all of the people who were already involved and draw from others.

Mr. MOLINARI. It started in 1979?

Mr. WILLIAMS. No, we started 2 years ago, in 1981. The names at the bottom of the cover sheet represent a great deal of expertise. We have airline captains with 35 years' experience. We have crash investigators, survival experts. Our members include pilots, flight attendants, doctors, businessmen. We are growing slowly, and I think we will grow a lot more.

Mr. MOLINARI. How are you funded?

Mr. WILLIAMS. By member dues. We are hardly funded at all.

Mr. MOLINARI. What success have you enjoyed so far?

Mr. WILLIAMS. The bill that Senator DeConcini is sponsoring is a notable milestone.

Mr. MOLINARI. That was a direct request of yours?

Mr. WILLIAMS. Yes.

That was a joint effort by the pilots, the flight attendants, the airline passengers' association, and others. We consider that an achievement.

It took a long time to gain. We are looking forward to others.

Mr. MOLINARI. I have no other questions.

Mr. LEVITAS. I have just one or two last ones.

Mr. Williams, is there any requirement that these flashlights, that are supposed to be on aircraft are required to be periodically checked?

Mr. WILLIAMS. Yes, sir.

The airlines maintain forms but the flashing LED is—once it decays to a certain point, then you have an indication that it is time to change the battery. There is a little red light on here.

Mr. LEVITAS. Recently the chief counsel of our subcommittee flew on a flight and the necessity arose to use a flashlight, and I think it was the fifth one that finally worked on board this aircraft.

Mr. WILLIAMS. This type of light?

Mr. LEVITAS. No, it was not that type of light. It was the only one on board.

Mr. WILLIAMS. If they do not have this light, they have the type—the flight attendants are required to carry a flashlight. It may be a pen light, it may be anything. There is no specification, no required specification, nothing.

Mr. LEVITAS. The other question I wanted to ask is of Dr. de Steiguer. You were involved in writing a document known as Analysis of Potential Protective Breathing Devices Intended for Use by Aircraft Passengers, dated January, 1983; is that correct?

Mr. DE STEIGUER. I authored the paper prior to leaving the FAA. It was a rough draft in October of 1982.

Mr. LEVITAS. So it was over a year ago that this document was completed.

Mr. DE STEIGUER. Yes.

Mr. LEVITAS. Do you know whether it has come out?

Mr. DE STEIGUER. I inquired before coming here, and was told it is in the printer's and expected. That is as much as I can find out.

Mr. LEVITAS. Do you have any understanding why once the document dated January 1983, was ready to be printed, it took so long?

Mr. DE STEIGUER. One of our problems is trying to satisfy everyone who edits the paper. We find that if someone does not like it, they send it back, and then the next person does not like something else, so it is redone again.

Mr. LEVITAS. What is the difference between a TSO and an FAR?

Mr. DE STEIGUER. The TSO generally specifies a test procedure or a demonstration of function. There is nothing in a TSO per se that requires that a device must meet that TSO.

The FAR's would provide that requirement and reference a TSO as being the functional or test requirement.

Mr. LEVITAS. So a TSO is not really mandatory in the way an FAR is?

Mr. DE STEIGUER. That is correct.

Mr. LEVITAS. It is a TSO that is being proposed for the protective breathing device for flight crews?

Mr. DE STEIGUER. The TSO for protective breathing equipment for flight crews have already been published, but there is no requirement as yet that the equipment aboard the aircraft must meet the test procedures of the TSO.

Mr. LEVITAS. Well, gentlemen, I want to express my gratitude to all three of you. You certainly have enlightened the subcommittee today about some additional problems that we face in dealing with the problem of aviation safety, and you have made a real contribution.

I hope that maybe for once we can get some response before that accident happens, rather than afterward.

On behalf of myself and all of the members of the subcommittee, I want to express our appreciation to you.

Is there any further business to come before the subcommittee? If not, the subcommittee will stand adjourned.

[Whereupon, the hearing was adjourned at 12:45 p.m.]

○